THURSDAY, OCTOBER 7, 1886

ORCHIDS

Reichenbachia: Orchids Illustrated and Described. By F. Sander, assisted by Eminent Scientific Authorities. Magnificently Illustrated in Colours. (London: Sotheran and Co., 1886.)

THE first two parts of a new illustrated work on orchids are now before us. It is called "Reichenbachia," in honour of Prof. Reichenbach, of Hamburg, our greatest living authority on the Orchideæ. The author of the work, which is to be published in monthly parts in an "ordinary," and an "imperial" edition limited to one hundred copies, is Mr. F. Sander, a well-known importer of, and dealer in, orchids at St. Alban's. While justice should be done to the author's energy and enterprise in undertaking so sumptuous and, so far as it has gone, so promising a production, it should be remembered that his business interests are connected with it.

Each part of the larger edition contains four plates in imperial folio, with botanical and horticultural descriptions in English, French, and German, geographical and cultural details being also given. The botanical descriptions are by Prof. Reichenbach, who is responsible also for the dissections. Why, we may ask, are the descriptions of the dissections sometimes in English and sometimes in Latin? This query leads to the remark that the custom of giving botanical descriptions in Latin has led to the creation of what we venture to designate as a most extraordinary, barbarous, and unintelligible jargon. In this work, as in any other botanical book where the descriptions are in Latin, words are to be found in numbers which are in no sense Latin. Scientific descriptions may require the invention of words or terms; but the supposed convenience of their being understood, when in Latin, by men of science of all nations is hardly a sufficient justification for the wholesale creation of such a language. We may add that we submitted one of the Latin descriptions in this work to the head master of a great school, who was unable even to suggest a meaning for some of the terms.

The plates in "Reichenbachia" are unquestionably superior, taking them one with another, to those in any modern botanical work we are acquainted with. They are far in advance both in drawing, and in truth and delicacy of colouring, to the "Orchid Album" of Messrs. B. S. Williams and Sons, or the "Lindenia" of the Continental Horticultural Company of Ghent. They do great credit to Mr. H. G. Moore, one of the best of our young horticultural artists, and to Mr. J. L. Macfarlane, whose work as a natural history lithographer it would be difficult to surpass. We are disposed to take exception to a remark made by Prof. Reichenbach, under Tab. I., *Odontoglossum crispum*, that Bateman's "Monograph of Odontoglossum" is "perhaps the finest book on orchids that has ever been issued." In our judgment it will not compare with the earlier work by the same author, the splendid "Orchidaceæ of Mexico and Guatemala." Of the eight plates in the two parts under review we consider Tab. IV., "*Odontoglossum Rossii rubescens*," the truest to nature, as well as the most artistic. The least satisfactory is Tab. VI., *Calogyne cristata maxima*," in which the hairs on the tip, though shown in the dissection, are not even suggested. We must here, with all respect and deference to Prof. Reichenbach, demur to the varietal name *maxima*. The flowers of this variety may be a little larger than the type, but if it be named *maxima*, what are we to call a larger variety, should one turn up, as is by no means unlikely? These superlatives are more in keeping with the aims and objects of trade than with those of scientific nomenclature. The nurseryman naturally revels in such adjectives as "superbissima," "brilliantissima" (!), "delicatissima," "magnifica," &c., but science should repudiate them. Tab. III. represents a recently introduced Venus's Slipper, from the Malayan Archipelago, called *C. Sanderianum*, which has not been seen in flower, we believe, outside Mr. Sander's nursery. We hope the remarkable drawing does not do more than justice to it. The plant is especially interesting in that it is an almost exact Eastern counterpart of the now well-known *Cypripedium caudatum* from South America, which was first flowered by the late Mrs. Lawrence, of Ealing Park, about fifty years ago. Tab. I. represents the most beautiful and popular, and what is now the commonest and cheapest of the Andean cool orchids, *Odontoglossum crispum*. We cannot admit that there is any scientific distinction maintainable between *O. crispum*, *O. Bluntii*, and *O. Alexandræ*, such differences as there are being purely horticultural. In view of the latest achievement of the busy laboratory of Messrs. Veitch and Sons, where during recent years more species of one genus, Cypripedium, have been created than have been gathered for us from nature by the whole army of collectors, botanists will have to reconsider, it would seem, not only the species of orchids, but the genera. Messrs. Veitch have now in flower a hybrid between *Sophronius grandiflora* and *Cattleya intermedia!* At the Conference last year, and again at the recent Provincial Show of the Royal Horticultural Society at Liverpool, the attention of botanists and horticulturists was drawn to the confusion into which the nomenclature of orchids had fallen, a confusion rapidly becoming worse confounded. We have examples of this in *Odontoglossum crispum* with its many synonyms and varieties, and in *Cattleya Dowiana*, Tab. V., which was re-christened *C. aurea*, simply because it was found in a new habitat. A new name should never be accepted, any more than a new genus or species, unless it be stamped with the approval of a recognised botanical authority. At present the latest and rawest recruit among the rapidly increasing band of orchid growers thinks nothing of coining a new specific or varietal name, which generally takes the shape of a supposed Latinisation of his own name.

The cultural directions are generally judicious. It is impossible to lay too much stress upon the necessity of giving orchids, whether Mexican or East Indian, the period of rest they have in nature. Mr. Sander proscribes houses with a north aspect for cool orchids. Some of the finest Odontoglossa and cool Oncidia we ever saw were grown in a house facing due north. We cannot indorse the recommendation of cocoa-nut fibre refuse or peat-moss manure either on or under stages. They rapidly decay, and become covered with fungi, and full of wood-lice and

other pests. One of the great difficulties in growing orchids and other plants under artificial conditions is due to the injury caused by insects. Any one with a knowledge of chemistry and of vegetable physiology would find, we believe, a profitable field of inquiry in this direction. Amateurs and the trade alike have dealt with this difficulty by rule of thumb for generations, and confined themselves to smoking plants with tobacco in various shapes, and treating them with quack insecticides. So far as tobacco-smoke is effectual, its effect is probably due to the nicotine it contains. There can be no insuperable difficulty in charging the air of a closed house with nicotine fumes sufficiently to destroy insects, and in thereby getting rid of the pungent and injurious smoke produced by burning coarse tobacco and brown paper. In conclusion we may express a hope that this work will not come to a premature end, like some of its predecessors, but live to fulfil the promise of the parts here noticed.

ARC AND GLOW LAMPS

Arc and Glow Lamps. A Practical Hand-Book on Electric Lighting. By Julius Maier, Ph.D. (London: Whittaker and Co., and G. Bell and Sons, 1886.)

WE should have been glad if it had been possible to speak more favourably of Dr. Maier's work than can be done after a conscientious reading of it; for Dr. Maier has made himself so thoroughly master of our language, and has taken such obvious pains to acquaint himself with the literature of electric lighting, that we cannot help wondering how so able a man has produced such a disappointing treatise. Much of the work appears to have been translated from Merling's and other German books on electric lighting. Perhaps it is to this composite origin that the defects are due which a reviewer is bound to point out.

The first 82 pages are occupied by generalities such as the laws of production of heat in the circuit, the efficiency of dynamos, electric and photometric measurements. Then come 60 pages upon arrangements of leading wires and of lamps in installations for electric light, including the so-called "secondary generators" or induction coils for distributing alternating currents. At p. 140 we at last reach arc lamps, the principal types of which are described with care. Twelve pages are allotted to the now almost obsolete electric "candle," and at p. 263 we enter upon the glow lamps. These are described all too briefly, especially so far as relates to the details of manufacture; but the data as to tests of efficiency and durability of the lamps are most satisfactorily summarised. This chapter includes an abstract of the tests made by the Philadelphia Committee, whose method of testing the lamps and of deducing the "mean spherical intensity" of the illumination is perhaps more scientific than that of any of the numerous Exhibition committees who have reported on electric lamps. The book concludes with special chapters on the application of electric light to lighthouses, ships, mines, railway trains, photography, and operative surgery.

There are several contradictory statements in Dr. Maier's book. On p. 270 he tells us that after the inventions of Greener and Staite in 1846 electric lighting fell completely into oblivion till 1873, when Lodyguine took up the question. Yet on p. 148 we find a description of improvements made in 1857 by Lacassagne and Thiers, and on p. 362 we find that electric light has been used for stage purposes ever since the production of Meyerbeer's opera of "Le Prophète" in 1846. The records of the English Patent Office between 1846 and 1873 show abundant evidence to negative Dr. Maier's statement. In that interval came the invention of the lamps of Serrin, Chapman, Way, and Browning, and the successive improvements of Holmes, Siemens, the Varleys, Wheatstone, Wilde, and Gramme in the magneto- and dynamo-electric generators for lighting purposes. On p. 32 it is stated that the drawback of the system of arranging lamps in series in one circuit lies in the fact that the individual lamps are not independent of one another; yet on p. 94 and p. 184 it appears that there are means by which any lamp is made quite independent of all the other lamps in the series.

We object entirely to Dr. Maier's classification of arc lamps into "monophotal" and "polyphotal"; these high-sounding names being respectively applied by him to lamps that will not work, and those that will work, when more than one is placed in series in the same circuit. The distinction is entirely misleading: for the question whether one or many lamps can be worked together depends quite as much on the dynamo as on the lamps. Every one knows that modern dynamos are so designed as to work under one of two standard conditions: they must either yield a constant current in the line, or else must maintain a constant difference of potential between the distributing mains. As a rule arc lamps arranged to work in series in a constant-current circuit will not work if set in parallel across the mains of a constant-potential network, and *vice versâ*. The true classification of lamps should therefore be into constant-current lamps which will work many in series, and constant-potential lamps which will work many in parallel. Probably the only lamp that will not fall in one of these two categories is the old regulator of Duboscq and Foucault. Most of the lamps classified by Dr. Maier as monophotal, and which according to him can only be worked each with its own separate dynamo, will work perfectly well in parallel with one another on a constant-potential system of mains. One consequence of Dr. Maier's curious classification is that when he comes to the Gülcher lamp, which is an excellent lamp for lighting in parallel, he cannot put it under either head, and it is relegated to miscellaneous lamps. Of the lamps which he describes as polyphotal, the very first is Lontin's modification of the Serrin lamp; but curiously enough the lamp figured and described in the text is *not* Lontin's but is the old unmodified Serrin, which, though stated by Dr. Maier to be monophotal, is really exactly in the same category as Gülcher's lamp. The lamp of Street and Maquaire is stated to be different from all other arc lamps in employing a vibratory principle: the author appears not to know that the lamps of Clark-Bowman, Newton, and Pieper also have vibrating mechanism. Amongst other erroneous points it is stated on p. 321 that Edison was the first to point out the advantage of high electromotive force in the glow lamp; on p. 324 that the Lane-Fox pump gives "infinitely better results" than the Sprengel or Geissler pumps; on p. 305

that carbon is deposited "electrolytically" in the flashing process of heating in a hydrocarbon vapour; on p. 31 that it requires "several" dynamos instead of one to yield an electromotive force of 2500 volts; on p. 27 that Ohm's law is true for the whole circuit only, and not for its parts; on p. 91 that a shunt coil was first used in an arc lamp by Von Hefner Alteneck; on p. 14 that "the velocity of a body falling through a vacuum" is "9·81 metres in one second." The definition of the ohm as originally fixed in 1862 by the Committee of the British Association was certainly not "equal to the resistance of a column of mercury of 104 centimetres in length and 1 square millimetre section," as stated on p. 13. There is a grossly misleading extract from Merling's work given in pp. 15 to 28 on the distribution of heat in an electric circuit. The old battery rule of arranging internal resistance equal to the external to get maximum current is trotted out, without a word of warning that this is an arrangement always to be avoided on account of its bad economy; and as if this were not bad enough, an algebraic corollary is added showing that this arrangement of maximum current is such as to make the maximum rate of output of heat in an external conductor of given resistance one-quarter of the output that there would be in the circuit if the battery were short-circuited. The student will at once draw the erroneous conclusion that at least three-quarters of the heat must necessarily always be wasted. But to make matters still worse, on p. 24, where the grouping of the battery is still under discussion, it is stated that in "no case can we obtain more heat," in the conductor of given resistance, than the quarter previously mentioned. This is entirely untrue; for if the cells be grouped all in parallel so as to reduce the internal resistance to a minimum, then a very high percentage of the heat of the current—practically all of it—will be obtained in the conductor of high resistance, and the zincs of the battery will consume more slowly. There are several other matters to which exception must be taken: a crude assertion that a Gramme dynamo is better than a Siemens, which may have been true in 1878; crude statements true perhaps of a particular dynamo or a particular lamp, but not true of dynamos or lamps in general; crude advice to makers to arrange their lamps so as to keep the resistance of the arc constant; crude arguments in favour of using shunt-wound electro-magnets in arc lamps, all reasons being given except the right one. Three times Dr. Werner Siemens's name is erroneously given as Wilhelm Siemens. Lastly, electric engineers will be surprised to find amongst the practical hints nothing about the "striking" of the arc, or about the "hunting" action of lamps and its avoidance. It is to be hoped that these matters will be remedied when the author comes to rewrite his book for a second edition.

S. P. T.

DISORDERS OF DIGESTION

On Disorders of Digestion. By T. Lauder Brunton, M.D., F.R.S. (London: Macmillan and Co., 1886.)

THIS book is a reprint of a series of disconnected papers which the author has contributed during the last thirteen years to various periodicals and Societies, and is prefaced by the Lettsomian Lectures, "On Disorders of Digestion," in which the author has collected together into one homogeneous whole many of the observations and illustrations which he had introduced into his earlier papers. These lectures give a most admirable *résumé* of the latest advances in our knowledge of the complicated processes of digestion and of mal-digestion, and the succeeding papers form a most interesting study of the gradual development of the author's views.

The main idea which runs throughout the whole work, and which the author more than any one else in this country has developed, is that, in mal-digestion, products are formed which in their passage through the liver disorder its functions, and on reaching the general circulation act more or less as poisons, producing languor, listlessness, heaviness of the limbs, great depression of spirits, and headache.

Brieger especially has worked out both chemically and physiologically the products of digestion and decomposition of food-stuffs. He has been able more or less successfully to separate several alkaloids which have most powerful effects when administered to animals. Several resemble very closely in their effects muscarin, the active principle which Prof. Schmiedenberg has separated from several species of mushrooms. This when administered to animals causes vomiting, purging, dyspnœa, and prostration, and it has been found that atropia is an efficient antidote. Many of these alkaloids are detained by the liver, and excreted with the bile into the intestine, again to be later on re-absorbed by the portal circulation, and may thus circulate in the portal system without ever entering the general circulation. Lead, copper, and other minerals, when administered by the mouth, often circulate in this manner, and the same process is offered as an explanation of the trivial effects of curara when swallowed, while its subcutaneous injection is lethal.

The author's views are corroborated by recent researches which allot a most important part in all digestive processes to bacteria and other micro-organisms. Cultivations carried on at Leipzig have shown that twenty-five micro-organisms are commonly found in the mouth, and that these under certain conditions may occasionally develop in various parts of the alimentary canal. Some develop large volumes of gas, and others lactic, caproic, caprylic, butyric acids, or other complex bodies during their growth. It is extremely probable, therefore, that the excessive multiplication of these micro-organisms generates the products of mal-digestion. A healthy condition of the alimentary canal and its secretions is inimical to their growth. A slight degree of acidity—less even than that normally present in gastric juice—is quite sufficient to check their growth.

These experiments open up quite a new field for the treatment of dyspepsia: the actions of old well-established remedies receive a new explanation, and new drugs will be pressed into the service.

Bitters are said to be beneficial because they check the secretion of mucus, which is a suitable nidus for some bacteria; mineral acids, mercury and salicylic acid are more strongly recommended than ever because of their antiseptic properties; charcoal, bismuth, and alkalies base their claim for support on their stimulation of the gastric secretion.

The title of the book is used in a very wide sense, and at the end is a series of articles on renal secretion, its disorders and treatment. Nowhere does the author better show his powers of dealing with complicated problems—marshalling together his facts, and then in the most lucid and pleasant manner, often assisted by apt illustration, setting forth his view of the question. Great stress is laid upon the distinct blood-supplies of the glomeruli, and of the convoluted and straight tubes, and upon the distinct regulating mechanisms, while an attempt is made to classify diuretics accordingly.

ALCHEMY

Die Alchemie in älterer und neuerer Zeit. By Hermann Kopp. Pp. 685. (Heidelberg: Carl Winter, 1886.)

THIS work is in two parts; the first part treats of alchemy up to the year 1775, and the second part subsequent to this date.

It is not written purely for the chemist, and indeed the student who looks here for the minor details of alchemy will be disappointed. These have already received ample treatment at the hands of Prof. Kopp in his "Beiträge zur Geschichte der Chemie," and the object of the present work is rather to lay stress upon the philosophy of the alchemists, to give some account of the organisations from which they received support, and to point out that such organisations had wider aims and a more distinguished following than is perhaps generally known. It will be read with as much pleasure by the student of literature and history as by the chemist. The difficulty of dividing a work of this nature into chapters is no doubt great, but we cannot help thinking that such a division would have been conducive to clearness; there is, however, a table of contents, a full and well-arranged index, and change of subject is indicated in the text by a break in the paragraphing. We have presented to us alchemy as a search after scientific truth under the guidance of principles which if ill-founded were yet sufficiently real to attract philosophers as well as representatives of wealth and power; as a science which survived persecution and failure, and whose allurements outlived the discredit brought upon it by dupes and swindlers. The relation between alchemy and medicine is traced in an interesting and careful manner. Although it has been by no means the author's intention to act as biographer, yet we have, if we may so speak, medallions of many of the more distinguished alchemists, in which the features calculated to indicate the growth and progress of principles are brought out with great clearness. Of such a type is the sketch of Leonhard Thurneysser, whose chequered career is indeed a romance of real life. In the second volume we have an interesting account of the "Rosenkreuzerbund," a secret society founded by Christian Rosenkreuz at the beginning of the fifteenth century. In this and kindred societies the "brothers" were encouraged to travel, gaining experience and knowledge which at their periodical meetings were retailed for the common interest and instruction of the members. Considerable latitude was allowed to the individual, and the following lines, by one who was himself connected with such a society, show that there was not always a servile respect for tradition:—

DER WEISE UND DER ALCHYMIST

Gesund und fröhlich, ohne Geld
Lebt einst ein Weiser in der Welt.
Ein Fremder kam zu ihm und sprach: "Auf meinen Reisen
Hört ich von deiner Redlichkeit;
Du bist ein Phönix unsrer Zeit.
Nichts fehlt dir als der Stein der Weisen.
Ich bin der Trismegist, vor dem sich die Natur
Stets ohne Schleier zeigt; ich habe den Merkur,
Dadurch wir schlechtes Blei in feines Gold verkehren—
Und diese Kunst will ich dir lehren."
"O dreimal grösster Trismegist!—
Versetzt der Philosoph—du magst nur weiter reisen!
Der ist ein Weiser nicht, dem Gold so schätzbar ist.
Vergnügt sein ohne Gold, das ist der Stein der Weisen."

The constitution of these societies is explained, and we are initiated into the mysteries of the various grades of rank: the juniors, the theorists, the practitioners, the philosophers, the minors, the majors, the adepts, the magister, and finally that rarest honour, the magus.

A considerable space is occupied with the history of one who was ever active in the welfare of such organisations—Georg Forster—born near Danzig in 1754. He was a remarkable man in every respect, unstable to a degree, holding peculiar opinions on religious topics, unskilled in all which contributes to success in the general occupations of life, and yet wielding powerful influence in the circle within which he moved. His earlier travels led him to England, where he was at the age of thirteen engaged in teaching French and German in a school at Warrington; then he passed into the East India Company's service; whilst at the age of eighteen we find him as a companion of Cook in his second voyage round the world; later he returned to the Continent, and became Professor of Natural History at Halle. Some thirty pages are devoted to a charming sketch of Georg Forster's character, and we do not know any other passage which affords such enjoyable reading.

S. Th. Sömmering was Forster's bosom friend and companion, a man not unlike him, and who shared all his trials and difficulties. In the concluding pages of the book it is shown how with the dawn of dynamical and quantitative ideas in chemistry at the close of last century, alchemy underwent modification, and, ultimately, rapid decline. One is tempted to wish that the author had given a concluding chapter on the rise and development of the principles of chemistry as shown by an examination of the doctrines of the alchemists.

Notes and references have been freely used throughout the work, and where remarks of such a length are required as to interfere with the continuity of the text, these are arranged in an appendix. These addenda occupy over 200 pages, and constitute in fact a most valuable contribution to the history of alchemy. The style and general character of the work will appear from the remarks that have been already made, and if there are occasionally passages that are somewhat abstruse, yet on the whole we have a clearness and picturesque delineation excelling in our opinion, anything that has hitherto appeared on the subject, and we congratulate the veteran author on his success in a new phase of literary effort. Our English readers will be glad to know that the book is printed in Roman type, and can be had bound in boards.

G. H. BAILEY

OUR BOOK SHELF

La Terre des Merveilles. Par Jules Leclercq. (Paris: Librairie Hachette et Cie., 1886.)

IN this volume M. Jules Leclercq describes a visit made by him a few years ago to the Yellowstone National Park, during which he saw all the sights of this *terre des merveilles*. The writer is already well known in his own country as an accomplished writer of popular books of travel, and accordingly he makes the most of the Yellowstone region and its wonders. His sketches of these are preceded by a very interesting chapter on the early explorations of the territory, from the visits of the first adventurous trappers. There are two maps—one a detailed map of the "Park," the other a general map of part of the United States to show the position of the Yellowstone region. There is also a considerable number of illustrations. The volume is published in Hachette's "Collection des Voyages illustrés," and is a clever, well-written popular account of a district full of natural wonders.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

The Cereals of Prehistoric Times

MY friend Mr. Carruthers in the interesting address delivered recently to Section D of the British Association, makes a remark which I confess surprises me. He says (NATURE, September 9, p. 453):—"It is remarkable that in our own country, with all the appliances of scientific cultivation and scientific farming, we have not been able to appreciably surpass the grains which were harvested by our rude ancestors of 2000 years ago." He mentions in support of this conclusion that "the wheat from lake-dwellings in Switzerland for which I am indebted to Mr. J. T. Lee, F.G.S., are fair samples."

This is certainly a striking fact. The persistence of specific and even of varietal types in a country like Egypt is what we might expect, because the very preservation of the material evidence is a proof that the physical conditions have persisted likewise. But that cultivated plants have remained unaltered since the Stone Age seems a conclusion difficult to accept in the face of every-day experience as to what can be done in modifying them. The data collected by Prof. A. De Candolle ("L'Origine des Plantes cultivées," pp. 284, 285) leads me, I think, to the conclusion that Mr. Lee's specimen must be exceptional. Prof. De Candolle mentions three varieties of wheat as cultivated in the Stone Age; of these he says:—"Aucune n'est identique avec les blés cultivés de nos jours. On leur a substitué des formes plus avantageuses." Two of these have been obtained from lacustrine dwellings. He remarks that the most ancient lacustrine people of Western Switzerland cultivated a wheat with small grains, which Heer has carefully described and figured under the name of *Triticum vulgare antiquorum*. These people he regards as contemporaries of the Trojan war, if not older. The culture of this kind of wheat persisted in Switzerland till the Roman conquest. Unger found the same form in a brick of the pyramid of Dahschûr in Egypt of the date B.C. 3359. The other variety (*Triticum vulgare compositum muticum*, Heer) was less common in Switzerland in the first age of stone, but is the one most frequently found in the less ancient lake-dwellings of Western Switzerland and Italy.

W. T. THISELTON DYER

Physiological Selection and the Origin of Species

HAVING written for the *Fortnightly Review* a full reply to Mr. Wallace's article in that journal, I will not here anticipate what I have there to say. But, seeing that he has repeated in these pages the substance of his criticism, I will here also repeat the substance of my reply. On the present occasion, therefore, it is enough to remark that I have never made the "extraordinary statement that, during his whole life, Mr. Darwin was mistaken in supposing his theory to be a theory of the origin of species." On the contrary, as I shall hereafter show, so far as this matter is concerned, both my opinions and my statement of them are in full agreement with those presented in Mr. Darwin's works.

Without wishing to discuss with Mr. Francis Darwin the meaning of the sentence which he quoted from the "Origin of Species," I feel it is only due to my own understanding to give the following explanation. If any one will turn to the sentence in question (p. 247, 6th ed.), he will find that it constitutes an integral part of an argument showing that sterility between species cannot have been brought about by natural selection. The argument is that, *even supposing sterility with parent forms to be an advantage*, it is an advantage which could not be seized upon by natural selection, and hence that some other explanation of such sterility must be found. Now, so far as I can see, there is here not only no shadow of the theory of physiological selection, but the whole argument is proceeding on totally different lines. For the very essence of this theory is that the sterility in question *need not be supposed to be an advantage*, and therefore that any variation in the way of such sterility *does not require* to be selected through the struggle for existence, being of its own nature a variation which survives. In no part of Mr. Darwin's writings can I find even the most distant allusion to the possibility of this particular variation being thus a variation *sui generis*—itself a cause of specific differentiation, and, as such, independent of natural selection. Least of all can I find evidence of any such allusion in the pasage referred to, seeing that the argument here consists in expressly regarding the variation of sterility as resembling variations in general, and therefore in *not* regarding it as possibly presenting the highly peculiar quality of being survivable *per se*. And, considering how fully Mr. Darwin has given his reasons for rejecting many ideas much less feasible, I confess it appears to me a most extraordinary and unaccountable thing that he should nowhere have so much as mentioned this alternative, had it ever been familiar to his mind. I may add that, if any reasonable ground can be shown for supposing this to have been the case, it would cause me to abandon the whole research.

Mr. J. H. A. Jenner's remark cannot apply to the particular kind of variation with which alone my theory is concerned, because, if so, it would amount to saying that the more sterile the variety is with its parent form the more will this sterility be increased by intercrossing with that form, which is absurd. But with regard to many other kinds of *beneficial* variation the remark of course is true.

I am greatly obliged to Mr. Evershed for directing my attention to Mr. Catchpool's letter in NATURE (vol. xxxi. p. 4). Having obtained a copy of the issue referred to, I find, as he says, that "the theory of physiological selection is very clearly put forward." Moreover, the difficulties against the theory of natural selection on account of inutility and sterility are very clearly stated. I may take this opportunity of requesting any of your readers who may know of any previous publications of the theory—no matter how vague or sketchy—to be kind enough to furnish references.

GEORGE J. ROMANES

Geanies, Ross-shire, September 18

Cooke's "Chemical Physics"

IN your issue of September 2 (p. 405) I find under the cover of a review of Cooke's "Chemical Physics" that Prof. Armstrong has been good enough to quote a passage from my "Lessons in Elementary Chemistry," though without naming the source, concerning Avogadro's law, about which he asks the question, "Could anything be more misleading and inaccurate?" My friend appears to be no exception to the well-known rule as to critics failing to read the books they review, for a note on the same page (55) disposes of the "inaccuracy," whilst the "misleading" statement is explained further on (p. 154). On the other hand, Dr. Armstrong has not followed the usual practice of critics, who, not being authors, escape from the danger of a retort courteous from those whom they find fault with; and hence I feel sure he will forgive me in saying that, whilst fully agreeing with him in the statement that a knowledge of mathematics is advisable for a chemist if he is to understand physics and physical

methods, I still am bold enough to ask whether anything can be "more misleading and inaccurate" than the formula for reduction for temperature and pressure given in both editions of his "Organic Chemistry" under the description of Dumas's vapour-density method. And to add that no excuse can here be found of a correction given elsewhere, or of the fact that it may be desirable sometimes to state a case broadly to begin with and to define it more closely afterwards. HENRY E. ROSCOE

The Tangent-Galvanometer

ATTENTION has recently been drawn more than once (notably by Sir William Thomson, and by Mr. W. H. Preece and Mr. Kemp) to the advantages offered, in certain cases of the use of the tangent-galvanometer, by placing the instrument so that the plane of the coils makes a greater or less angle with the plane of the magnetic meridian. It may not be amiss, therefore, to point out that, in 1869, M. Bertin showed that the sensitiveness of the tangent-galvanometer for strong currents may be increased and the usable range of deflection doubled by placing the circle in a vertical plane inclined at an angle of 45° to the magnetic meridian (*Annales de Chimie et de Physique*, 4th series, vol. xiv. p. 27).

When readings are taken with the current traversing the galvanometer, first in one direction and then in the other, as would always be done if accuracy were important, the expression for the strength of current is almost as simple when the coils make an angle with the magnetic meridian as when they are parallel to it. In the former case the strength of current is

$$C = \tfrac{1}{2}k \cos\alpha\,(\tan\theta + \tan\theta'),$$

where α is the (fixed) angle between the plane of the coil and the magnetic meridian, and θ and θ' the deflections of the needle from the plane of the coil due to the current in the two directions. θ is reckoned positive in the direction from the plane of the coil towards the plane of the meridian, and θ' is reckoned in the opposite direction. To determine the angle α we have

$$\tan\alpha = \tfrac{1}{2}(\tan\theta - \tan\theta'),$$

and it is probably most convenient to determine the numerical value of $\cos\alpha$ in the first expression from this by tables. If the current be adjusted so as to make the second deflection $\theta' = 0$, we have simply $\tan\alpha = \frac{1}{2}\tan\theta_1$, if θ_1 be the corresponding deflection with the current reversed. G. CAREY FOSTER

University College, London, September 30

Alligators in the Bahamas

IN Catesby's "Natural History of Florida, Carolina, and the Bahama Islands," published in the latter half of the eighteenth century, the author, usually a most accurate observer, states that the mangrove-swamps on the Island of Andros presented a loathsome appearance owing to the remains of fish having been left there, half eaten, by the *alligators*. During a fairly complete exploration of Andros, which I made in the early part of last year, I observed no traces of these animals, though, as I was not then aware of Catesby's statement, I did not make any special search for them. In response, however, to inquiries made in the local paper, I lately received from the Rev. W. L. de Glanville, Rector of Inagua, Bahamas, a letter from which the following is an extract:—

"Legendary stories of alligators having been floated to this island on logs of mahogany are numerous here. I have not succeeded in verifying any of them. On July 21, while on a visit to our North-West Point Settlement, a man exhibited to me the skin of an alligator which he had shot a day or two previously. Length all over, from tip to tip, 8 feet; from line at right angles to tip of snout to angle of jaw, 13 inches; greatest frontal diameter, about 11 inches.

"Logs of mahogany have been drifted recently on these shores, but no one saw an alligator arrive. That shot was on shore, and seen more than once."

As the distance from this to Inagua is more than 400 miles, I have not been able to make inquiries on the spot. But there seems to be no doubt that the alligator must have been carried by the current from the south-east on a log of mahogany or other wood from San Domingo to Inagua. It seems likely that alligators have frequently been drifted to that island, though the absence of a suitable environment has prevented their surviving. The conditions in Andros would suit them better, since about that island there is a considerable extent of fresh and brackish water in lakes, lagoons, and creeks. But it is not easy to understand how they could arrive at Andros, unless we suppose that the Gulf Stream carried them from the north-west coast of Cuba and cast them on the west side of the Great Bahama Bank, whence small local currents and the wind might bring them to the west side of Andros. The distance travelled would in this case be about 300 miles, or about twice as great as that from San Domingo to Inagua.

I trust that this note may be useful as affording further proof of the fact that oceanic currents take some part in the dispersion of even large animals. JOHN GARDINER

Nassau, Bahamas, September 15

Meteors—The September Taurids

ON September 22, 1886, 10h. 26m., I observed a fine meteor about equal to Jupiter, pursuing a path of some 7° in the extreme east region of Aries. It left a streak and moved somewhat slowly, being evidently foreshortened near its radiant point in Taurus. At 10h. 46m. the same night I noticed another meteor from the same direction.

On September 21, 1879, I counted 92 meteors, including several from this radiant in Taurus, and on September 22, 1884, two others were seen amongst 29 registered on that date.

A comparison of the paths shows a well-defined radiant at 63° + 23° (about 8° N.N.W. of Aldebaran), and I believe the shower is rather an important one, though not well visible until late in the night.

I have recognised several radiants from this position in Taurus in October and November, and in August Mr. Greg derived a shower at 64° + 22° from the observations in 1867-74, collected by the Luminous Meteor Committee of the British Association. On October 17-19, 1877, I found a radiant at 63° + 22°; on November 20, 1876, at 62° + 22½°; and on November 27, 1880, at 63° + 21°. There are also many other contemporary showers slightly south-west at about 59° + 20°, and it is in November that the display of meteors from Taurus reaches a maximum.

In September, during the last half of the month, I have determined some other showers in the region of Taurus, supplying meteors of much the same character. The chief additional centres of radiation seem to be at 74° + 14°, 70° + 4°, and 53° + 3°, and there is a fairly active shower also from a point further east, at 89° + 19°, in Orion. The first of these, near 11 Orionis, was splendidly defined from 8 bright meteors on September 27, 1886; and on September 22, 1871, Lieut.-Col. Tupman saw it at 75° + 15°. The Orionids at 89° + 19° were well seen in September 1877, and confirmed in September 1884, but this is essentially a morning shower, as the radiant does not reach a fair altitude for the dispersion of its meteors until the few hours preceding sunrise. W. F. DENNING

Bristol, October 3

Action of Light upon Diastases

IN 1878, in conjunction with Mr. T. P. Blunt (*Proc. Roy. Soc.* No. 191), I showed that the *inverting ferment* of cane-sugar is destroyed by oxidation on prolonged exposure to sunlight. Lately I have extended this observation to other ferments of the like kind, with similar result.

Twenty-five cubic centimetres of very active solutions of *malt diastase*, *pancreatic diastase*, and *trypsin* respectively were rendered inert by insolation in 50 cc. flasks for one month (August 25 to September 25).

A solution of *pepsin* was likewise destroyed, but in this case the ferment had been badly prepared, and was not very potent to commence with.

On the other hand, 25 cubic centimetres of solution of *rennet*, though distinctly enfeebled by insolation, still retained its specific properties at the end of the month. This immunity, however, was only relative, for a more dilute solution in a shallower stratum was almost entirely destroyed by one week's exposure to light (August 31 to September 7).

In all cases the contents of similar flasks kept under like conditions of temperature, &c., but in the dark, were found to be still active at the termination of the experiment.

In determining the peptonising power of the trypsin and pepsin, Grützner's method (carmine-stained fibrin) was very useful. I find, however, that it is more convenient and econo-

mical to keep the prepared fibrin by drying it in a current of air than to preserve it under ether, as usually recommended.

September 27 ARTHUR DOWNES

Note on Actinometry by Oxalic Acid

OXALIC acid is entirely oxidised by light (*Proc. Roy. Soc.* No. 191, and *Chemical News*, October 8, 1880), and affords, by reason of its own physical properties and those of the products of the reaction, an excellent medium for actinometry. A preliminary series of experiments on the physical conditions which modify this oxidation show that, *c.p.*, the effect is greater in direct proportion to the extent of exposed surface of the solution but inversely as its depth. It is greater also in proportion to the strength of the solution; and it would appear—I speak for the present quite provisionally—that in this relation the reaction follows a definite law, being *as the square root of the mass*.

September 27 ARTHUR DOWNES

Humming in the Air caused by Insects

IN a letter to the Hon. Daines Barrington (letter lxxx.) the Rev. Gilbert White, the well-known author of the "Natural History of Selborne," mentions a strange humming sound in the air. He writes:—"There is a natural occurrence to be met with upon the highest parts of our downs in hot summer days which always amuses me much without giving me any satisfaction with respect to the cause of it: and that is a loud audible humming as of bees in the air, though not one insect is to be seen. This sound is to be heard distinctly the whole common through from the Money Dells to my avenue gate. Any person would suppose that a large swarm of bees was in motion, and playing about over his head. This noise was heard last week on June 28."

It is singular that no explanation has been offered by any one for such a common phenomenon. I am convinced that the humming sound mentioned by Gilbert White was nothing more than the noise occasioned by the vibrations of millions of insects' wings in the air. In hot summer evenings in particular I have heard these peculiar humming sounds, and know them to be caused by immense hordes of gnats and midges which fill the air with their numbers. W. HARCOURT BATH

The Limes, Sutton Coldfield, near Birmingham, October

Mimicry in Snakes

A CURIOUS fact has been lately brought to my notice by a friend of mine, Mr. H. M. Oakley, in connection with the *Dasypeltis scaber*, Linn., or egg-eating snake—the "Eijer eter" of the Dutch colonists—which, if not already well known, may prove of interest to some of your readers. The specimen obtained by Mr. Oakley was caught at Hout Bay some twenty miles from Cape Town, and is about 3 feet in length, and its size, markings, and colour bear sufficient resemblance to those of the Berg Adder (*Clothos atropos*, Linn.) to be easily mistaken for that snake. It also has keeled scales, generally characteristic, at the Cape, of venomous species. Its head has, however, the long lacertine shape distinctive, here, of harmless snakes, but, when aroused and alarmed or irritated, it flattens it out until it assumes the usual viperine shape of the "club" in a playing card. It then coils as for a spring, erects its head with every appearance of anger, produces a hissing noise with its scales, not unlike the hiss of a puff adder or cobra, and darts forward as if to strike its fangs into its foe, and in every way exactly simulates the motions of an irritated berg adder. This snake has, however, neither fangs nor teeth (which, indeed, would not be required for egg-swallowing), and is not poisonous, a fact which was placed beyond doubt by Mr. Oakley repeatedly placing his finger in the reptile's mouth. This seems a clear instance of mimicry of another species for defensive purposes, but I am not aware of another instance among ophidians.

W. HAMMOND TOOKE

Cape Town, Cape of Good Hope, September 8

THE COLONIAL AND INDIAN EXHIBITION

CONTINUING our review of the most noteworthy or interesting vegetable products now being exhibited at South Kensington, we find in close contiguity to those from British Guiana, described in NATURE, July 15, p. 242, the exhibits from

Mauritius.—The entire collection, though not large, is one of some interest, and the vegetable kingdom plays by far the most important part in the exhibits. The collection of fibres will attract attention as much for its completeness as for the care with which they have been prepared. Many are of scientific interest only, being obtained from plants that could never be turned to commercial account, such, for instance, as *Hyophorbe Verschaffeltii*, *Latania commersonii*, *Lodoicea sechellarum*, *Macrozamia spiralis*, &c. This collection is exhibited by the Botanical Gardens, as is also a collection of woods of similar interest. Some notes on these woods are useful. Thus, we are told that *Tecoma pentaphylla* has a soft white wood, not much used, and that it is a moderate-sized shade-tree of rapid growth. Samples of the wood, however, grown in the West Indies, show a close and even grain, and are fairly hard—so hard, indeed, as to suggest its suitability for wood-engraving, for which purpose it has been tried in this country, and though not by any means equal to boxwood, was reported upon as likely to be found useful for some kinds of work. The soft wood of *Ficus mauritiana* is used in the colony both for firewood and for hollowing out for canoes, while the hard wood of the Ebony (*Diospyros Ebenum*), which is described as being either black or sometimes streaked with yellow and brown, is used for inlaying, furniture, and ornamental turnery. The Bois Maigre (*Nuxia verticillata*) is said to produce a short-grained timber which decomposes rapidly, but when young it makes excellent walking-sticks, which are much sought for. *Terminalia Benzoin*, a large tree, which has become scarce in Mauritius, produces a wood valued for many purposes. It would seem that the wood is sometimes fragrant, for it is said that "some parts of the tree were once much burnt in Mauritius as an incense." Another odoriferous wood is *Noronhia Broomiana*, called here Bois Sandal. The Carambole (*Averrhoa Carambola*), valued in India for the sake of its acid fruits, is planted in Mauritius for the same purpose, the fruits being eaten either raw or made into tarts.

Probably the exhibits that attract most attention in the Mauritius Court are the fine samples of vanilla pods, covered as they are with an abundant coating of crystals, and shedding forth, even through the glass cases which cover them, the delicate fragrance for which vanilla is celebrated.

Seychelles.—Amongst these exhibits the Double Cocoa-Nut, or Cocoa de Mer (*Lodoicea sechellarum*) is the most prominent. The double form of the fruit, which is its normal condition, is well shown, as well as a triple-lobed nut, which is not very uncommon. Here also are fine samples of vanilla, nearly, if not quite, equal to those from Mauritius. Dried papaw juice and some remarkably good specimens of essential oils are shown, all of which are extremely creditable to the colony.

Cyprus.—The vegetable products shown in this Court are not numerous, nor is there anything of novelty excepting perhaps a peculiar black substance described as honey, from the Carob or Locust Bean (*Ceratonia Siliqua*). The pods themselves are also exhibited, and their production, it seems, has greatly increased in recent years, stimulated by an increasing demand, especially in this country, where they are used very largely in making the patent compound cattle-foods, in consequence of their saccharine and nutritious character. Low freights have much encouraged the trade in carobs, enabling shippers to sell them at moderate prices. The quantity of carobs exported from Cyprus in 1884 amounted to 30,000 tons, about one-half of which came to England. The finest quality is produced in Limassol and Lefcara, and obtain relatively higher prices than those of Kyrenia. The average price realised for these pods is about 3*l*. per ton.

Another product of great importance to Cyprus up to

the year 1873 was madder from *Rubia tinctorum*, an article of considerable profit to landowners. It was largely used in dyeing Turkey-red yarns. The discovery of coal-tar dyes seriously interfered with the demand for madder, so that its growth has much decreased. In consequence, however, of the mineral dyes being much inferior in fastness, madder is being again sought after, and should the demand continue, there is a prospect that madder will again assume its former importance. Among other interesting exhibits, the rude native cart of the form in use for over 2000 years, and still in use, attracts much attention, as does the threshing-board, the same as was in use in patriarchal times. It is studded with flints on the under-side, and is drawn by bullocks or horses over the grain, by which means the seed is separated from the ears and the straw reduced to small particles. This is said to be the only system employed for threshing in Cyprus.

A few well-known woods, such as Olive (*Olea europea*), Cedar of Lebanon (*Cedrus Libani*), Bay Laurel (*Laurus nobilis*), Chian Turpentine, (*Pistacia Terebinthus*) are exhibited, as well as the concrete resin of the latter, or crude Chian turpentine, under the name of Trimithia gum, in curious small greenish-coloured pots.

Malta.—The Maltese exhibits will be best remembered by the fine show of lace and silver filigree work. A good show is also made of preserved fruits, and tobacco of very fine quality and varied forms is exhibited; besides these there are very few other vegetable products.

JOHN R. JACKSON

GREEK GEOMETRY

WE have before us parts 6, 7 (?), of Dr. Allman's "Greek Geometry from Thales to Euclid,"[1] in which we are brought almost into touch with Euclid. There is then but little wanting to complete the task commenced by the author in 1877, in the performing of which so much light has been thrown upon the contributions of the early Greek mathematicians to geometrical science.

In NATURE (vol. xxx. pp. 315, 316) we gave an account of Archytas and Eudoxus; the present parts commence with a discussion of the claims of Menæchmus, "pupil of Eudoxus, associate of Plato, and the discoverer of the conic sections." In the forefront are placed translations of eleven fragments which contain what is known of Menæchmus. The various points which arise are most carefully reasoned out, with considerable detail, but we cannot attempt here to compress what is already concisely given. The notes are very valuable, and show over what a wide field of reading Dr. Allman's researches have taken him. We note only the prominence given to M. Tannery's papers, as we have frequently had occasion in these pages to draw attention to this mathematician's valuable memoirs on Greek geometry. The last part (which we have numbered 7) opens with an account of Dinostratus, brother of Menæchmus, whose name occurs in connection with the quadratrix. Dr. Allman states the case of Dinostratus *versus* Hippias: "The result of the whole discussion seems to be that the quadratrix was invented, probably by Hippias of Elis, with the object of trisecting an angle, and was originally employed for that purpose; that subsequently Dinostratus used the curve for the quadrature of the circle, and that its name was thence derived." Sporus (or Porus) comes in for a mention, and then we come to Aristæus, who wrote on the conic sections, and is the author of the theorem, "The same circle circumscribes the pentagon of the dodecahedron and the triangle of the icosahedron, these solids being inscribed in the same sphere." This occurs in his "Comparison of the Regular Solids." Bretschneider thinks the thirteenth Book of Euclid's Elements is "a recapitulation, at least partial, of this work of Aristæus" (cf. also Dr. C. Taylor's "Conics," p. xxxiii.).

Of Aristæus, in closing, our author writes: he "may, therefore, be regarded as having continued and summed up the work, which, arising from the speculations of Philolaus, was carried on by his successors—Archytas, Eudoxus, and Menæchmus. These men were related to one another in succession as master and pupil, and it seemed to me important that the continuity of their work should not be broken in its presentation."

We hope another year will suffice to bring this sketch of Greek geometry to a close, and that then the author will collect these parts, whose appearances have been extended over nearly ten long years, in one volume, with such additional notes as his subsequent reading will enable him to append.

We can only commend these two parts, as we have the previous ones, to the careful study of all who are interested in these researches: they have taken a high place in the estimation of foreign mathematicians, even in cases where the author's conclusions have not been unhesitatingly accepted.

[1] The following references to the several parts may be of service:—Hermathena, part 1, vol. iii. No. 5, pp. 160-75; part 2, same number, pp. 175-207; part 3, vol. iv. No. 7, pp. 180-228; part 4, vol. v. No. 10, pp. 186-212; part 5, same number, pp. 212-235; part 6, vol. v. No. 11, pp. 403-32; part 7 (?), vol. vi. No. 12, pp. 105-30.

THE HYGIENE OF THE VOCAL ORGANS[1]

THE cultivation of the voice and the means of maintaining it in a state of excellence under the varying strain of daily life, are subjects of interest to us all, but become of paramount importance to those who are professionally brought before the public as speakers or singers. Although the laryngoscope is invaluable in the recognition and treatment of disease, it is surprising how little it has up to the present time added to our knowledge of the physiology of the larynx.

The difficulties of examining the larynx during singing are so great that a large number of singers have to be examined to obtain a complete view of the whole process by even the most expert laryngoscopist. The results of the examination of some three or four hundred persons with fine voices, including most of the best singers of the day, form not the least interesting portion of the book.

There is no question that the voice, whether the note be high or low, whether a chest or head note, whether bass or falsetto, is produced by vibration of the free edges of the vocal cords, which are two movable ligamentous bands about half an inch long stretched from back to front of the larynx. In other words, the only place where all notes, whatever their character may be, can be produced, is in the larynx.

These bands are attached anteriorly in contact with one another, but their posterior fourth is attached to the small pyramidal-shaped arytenoid cartilages, which can move laterally. The glottis, the space between them, is thus divided into a ligamentous and a cartilaginous portion. There is the greatest difference of opinion among authorities as to the position of the cords and arytenoid cartilages, and as to how much of the cord vibrates in the production of the various sounds.

Dr. Mackenzie divides the range of the voice into two registers, viz. one (chest) in which the pitch is raised, by means of increasing tension and a (consequent trivial) lengthening of the cords, as the voice sings upwards; the other (head), by which a similar result is brought about by gradual shortening of the vibrating reed, which is still tense, though less so than in the chest register. These fundamental divisions are the so-called chest and head modes of production, and the falsetto corresponds to the head register of the female voice, of which it is an imitation.

[1] "The Hygiene of the Vocal Organs." By Morell Mackenzie, M.D. Pp. 223. (London: Macmillan & Co., 1886.)

Speaking generally, it may be said that the cartilaginous glottis is generally open in the lower and gently closed in the upper notes of the chest, and that a segment of the ligamentous glottis is *tightly* closed in the head voice. The two registers may be called the long-reed and the short-reed, according to the length of the cord vibrating. It has also been noticed that the blast of air is much feebler with the head than with the chest voice.

The new and important observation which Dr. Mackenzie has made and amply verified is, that in the head note of women and in falsetto singing only the anterior third of the vocal cords, as shown in Figs. 3 and 4, vibrate, and that the remainder of the cords are in firm contact with one another. Only twice has he observed a vibration limited to the middle third of the cords, which has often been described as the usual one. Some observers have asserted that in falsetto only the extreme edge of the cords vibrates; but, as 12 inches is the nearest distance at which a good image can be obtained by the laryngoscope, only the mean position of the cords can be observed, and it is impossible to detect any vibration when a high note is being sung; and hence the author rejects the statements of those who profess to have observed vibrations limited to the edge.

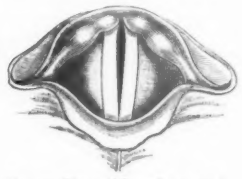

FIG. 1.—The position of the vocal cords for the lower range of chest notes.

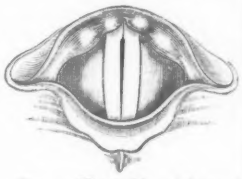

FIG. 2.—The position of the vocal cords for the higher range of chest notes

FIG. 3.—The position of the vocal cords for head notes.

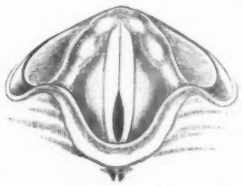

FIG. 4.—The position of the vocal cords for falsetto notes.

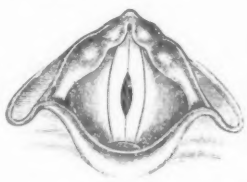

FIG. 5.—A very exceptional position of the vocal cords for head notes.

The long-reed or chest voice is generally used by sopranos, Figs. 1 and 2 showing the position of the cords in the case of Mesdames Nilsson, Albani, and Valleria; on the other hand, the high notes of mezzo-sopranos and contraltos are short-reed, *e.g.* Madame Patey, as shown in Fig. 3. Tenors use both reeds, while the long only is used by the basses, and commonly by the barytones.

Alto singers among men use the short-reed, whilst boys always use the long.

In falsetto the false vocal cords, which are movable bands of tissue superior to the true vocal cords, also approximate considerably.

The quality of a voice depends upon the accuracy with which the vocal cords are moved, on their tension, on the regulation of the respiration, on the position of the soft palate and fauces, and on the movements of the tongue and lips.

These points are all touched upon, but the details of the methods by which they are to be trained do not fall within the scope of this book, but belong to the domain of the singing-master.

A certain amount of vocal discipline is recommended for children as early as the age of five or six, or even younger, but it should be limited to simple airs of limited compass, such as those by Louisa Gray, published by Messrs. Wood and Co. They are warranted to contain "no love and no high notes," and may therefore be trusted not to inflame either the infant's tender heart or its delicate larynx.

Observations on 500 choristers have disproved the idea that "cracking" or "breaking" of the voice is an essential stage, for in only 17 per cent. did the voice become cracked in changing to the adult condition; and in these cases the cords were congested, and the state was due to over-exertion or to cold.

The hygiene recommended for vocalists may be summed up in the adoption of such a mode of life as is most beneficial to the general health; prompt treatment of any cold or hoarseness; and, if their faith is pinned on the virtues of raw eggs, champagne, or any of the thousand and one things recommended for the voice, they may be permitted, if they are not absolutely injurious.

The latter part of the book is occupied with the training of the speaking voice, an account of its various defects, and the methods of diminishing them.

Stammering, which depends on a defective control over the respiration and over the tension of the vocal cords, may be much improved by training; while stuttering, which depends on a spasm of the tongue and on imperfect control over the lips, is rarely benefited, except in the slighter cases. Strychnine is occasionally of use, while tobacco intensifies the difficulty.

Valuable hints for training the voice are given, and great stress is laid on the importance of a most accurate acquirement of the vowel sounds, when the consonantal follow readily.

A NEW CASE OF PARTHENOGENESIS IN THE VEGETABLE KINGDOM

EIGHT years ago I discovered in the *Quebrada* (*i.e.* ravine) of Guarenas, about nine miles to the east of Caracas, and approximately at 650 metres above the level of the sea, one of those charming groups of tropical vegetation, which are equally interesting to the botanist and to the lover of the picturesque beauties of nature. A magnificent specimen of *Pogonopus Ottonis* was all aglow with its large rosy sepals; up to its highest branches a luxuriant *Vitis caribæa* had ascended in graceful festoons, laden with blackish grapes, and displaying now and then in the gentle breeze the silvery glimmer from the under side of its palmate leaves; whilst in the damp shade underneath throve a colony of *Gloxinia pallidiflora*, a plant which from its bruised leaves gives out a smell identical with that of the spearmint.

My attention, however, was especially attracted to a tall suffrutescent climber with dark-green ivy-like foliage, and large drooping clusters of bright-red fruits, which I was sure I had never met with before. The general *facies* was certainly that of a menispermaceous plant; but the structure of the fruit proved to be utterly discrepant from anything I knew of this family. Flowers I found none, and a prolonged search in the neighbourhood for another specimen was to no effect. I gathered a quantity

of fruits, some of which were sown in the little garden belonging to the house I inhabited at the time in Caracas. Others I sent to several leading botanists in Europe, requesting them to give me their opinion about the plant; the result, however, was negative, the fruit being to all of them a puzzle, just as it had been to myself.

Meanwhile some of the seeds had germinated; I planted out three seedlings, which grew very vigorously, and in time produced an abundance of flowers, *all female ones*. Their structure gave additional weight to the supposition that the plant belonged to the Menispermaceæ, and believing it to be a new genus, I was anxious to discover the male plant. In this pursuit the botanical interest went hand in hand with that of the horticulturist; for although the plant is highly ornamental on account of its foliage, its principal merit as a decoration in a tropical garden consists in the striking contrast between the dark-green leaves and the large number of scarlet fruits, which bear the greatest resemblance to the half-ripe berries of the coffee-tree.

For a long time all my efforts were unsuccessful. I had moreover occasion to convince myself that the plant was extremely rare in our flora, as only in two places of the above-mentioned ravine a few specimens hitherto have been found by myself and my collectors.[1]

In 1881 at last one of my men brought me a plant which he pronounced to be a male one. The plant was set between two female ones, and after a couple of months I had the great satisfaction of beholding for the first time the *male* flowers that for several years had been the object of many a fatiguing search in the dense thickets of the little river of Guarenas. Both female plants produced now a large crop of fruits, though I was unable to make out by what agency the transport of pollen was effected. Of animals I noticed on the plants only a small species of a green *Tettigonia* (rather plentiful), some common mosquitoes, and a few caterpillars of *Ophideres cacica*.[2] It is not impossible that the mosquitoes were of some significance for the purpose of fecundation. I thought once the flowers might be of the anemophilous type; but this is certainly a mistake, as they are so much hidden amongst the foliage that the wind can hardly reach them.

I sent male and female flowers, as well as fruits, to Kew, and following the advice of Sir J. D. Hooker, likewise to Prof. Eichler, of Berlin, who recognised the plant as belonging to his genus *Disciphania*, and described it afterwards under the name of *Disciphania Ernstii* in *Jahrbuch des Kön. Botan. Gart. zu Berlin*, vol. ii., 1883, pp. 324-29, giving at the same time the analytical details of the flowers and fruit on Plate XII. of the volume referred to. As this work may not be easily accessible to all who take an interest in the facts I have to present hereafter, I deem it convenient to insert a summary description of the species, giving, however, a fuller development to certain structural particulars which, in my opinion, possibly may have some bearing upon the chief point of my communication.

Like many other Menispermaceæ, *Disciphania* bears root-tubers, which are, in good-sized plants, as large as a man's fist, and weigh 1 lb. and even more. They contain a considerable quantity of ovoid starch grains, the largest measuring 0·04 by 0·026 millim. The stem exhibits the compound structure usually found in climbing plants; it soon becomes woody in its lower part, whilst at the same time the periderm increases greatly in thickness, and forms a very irregular spongy bark. The younger parts of the stem, as well as the branches, generally wind around any support they may encounter; but sometimes they climb by means of the petioles, the basal part of which is rather abruptly thickened and variously curved, so that it serves as a hook, more or less, as in some species of *Clematis*. There are other branches which do not climb at all, but either hang down without showing any sign of torsion, or run in a straight line on the soil. The cortical system is very much developed, and the central parenchyma abounds in laticiferous cells, each one containing a great many nuclei and a viscid latex.

The leaves are most singularly polymorphous on the same plant, as will be seen from Figs. 12 to 16, which are copied, as likewise all the others, from Prof. Eichler's plate. The palmatisect leaf (Fig. 16) exhibits the basal thickening and inflection of the petiole, which I mentioned before.

The flowers are strictly diœcious, and in both sexes arranged in axillary, centripetal, and drooping spikes, measuring from 8 to 25 centimetres in length. The rachis of the female spikes is very thin at the basal end, where it is scarcely 1 millimetre thick; but it increases gradually in thickness, and in many cases it measures at the opposite end 3 millimetres by 2, so that the extreme transverse sections are in the ratio of 1 to 6 approximately. Its tissue is gorged with latex, especially in the thicker part, which has an appearance as if it were due to a kind of normal hypertrophy. Not having actually any fresh male inflorescences, I am unable to say whether their rachis presents the same structure; amongst my old notes I cannot find anything referring to it.

The flowers are so crowded that they touch each other, and hide the rachis and their little bracts completely. This is especially the case towards the apex of the spikes, where not unfrequently two or three empty bracts are found, undoubtedly indications of as many suppressed or aborted flowers. Figs. 1 to 3 represent the male flower; Figs. 4 to 7 the female one. Both have six large sepals and six very small petals; in the former there are three stamens, in the latter three pistils, but in none the slightest rudiment of the organs of the other sex is to be seen. I have carefully examined hundreds of female flowers, and can most positively assert that this rule holds good in every case, nor are there on the female plants any rudimentary male flowers, auxiliary stamens, or any other contrivances that could be considered as pollen-producing organs.

Fig. 8 represents an almost full-grown fruit in its natural size; Fig. 9 is the seed, viewed from the flat side, magnified 25 times; Fig. 10 is its longitudinal section, with the straight embryo *in situ*; and Fig. 11 is a transverse section of the same. The very peculiar wings of the seed develop gradually, as indicated by the letters *a*, *b*, and *c*, in the last-mentioned figure.

I have thought it necessary to give a rather lengthy exposition of introductory matter, before entering upon the principal object of the present paper. The question of parthenogenesis in the vegetable kingdom is still strenuously objected to by many botanists, although it is a thoroughly well-established fact in the domain of zoological science, so that there is *a priori* really no reason for denying its existence in plants. It is, however, of the greatest importance to give in any particular case a most substantial and complete record of the leading facts, as well as of the concurrent circumstances, so as to enable the reader to get a full view of the matter, and form his own judgment accordingly. I hope to do the second, as far as it is pertinent, and shall now proceed to relate my observations on, and experiments with, *Disciphania Ernstii*, from which I have come to the conclusion that in this species we have really *a new case of parthenogenesis in the vegetable kingdom*.

Long before I got the male plant of *Disciphania*, I had noticed that on my female plants appeared now and then a few fruits. Very naturally the idea crossed my mind that I might have before me a case of accidental

[1] It is a singular coincidence that in one of these places another very curious Menispermacea was found, viz. a female plant of *Odontocarya hederæfolia*, Miers.

[2] The caterpillar and pupa of this beautiful moth were on this occasion described for the first time. See a note, "Jugendstadien von *Ophideres cacica*," in Karsch, *Entomologische Nachrichten*, 1885, pp. 6, 7.

parthenogenesis ; I was, however, too much interested in obtaining, first, the missing sex, in order to make sure what species of plant was the subject of my researches.

In December 1881 I removed to another house, but before doing so I totally destroyed all my specimens of *Disciphania*, as I wished to begin my further investi-

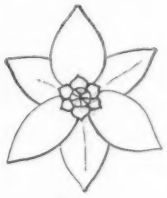

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

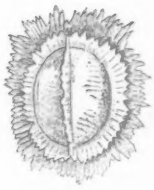

FIG. 9.

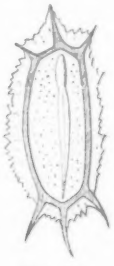

FIG. 10.

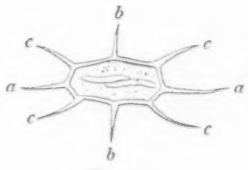

FIG. 11.

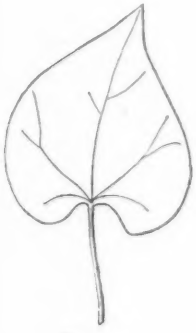

FIG. 12.

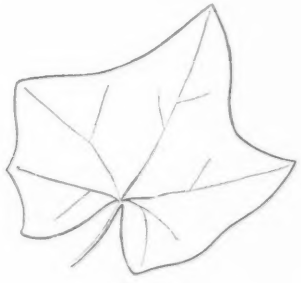

FIG. 14.

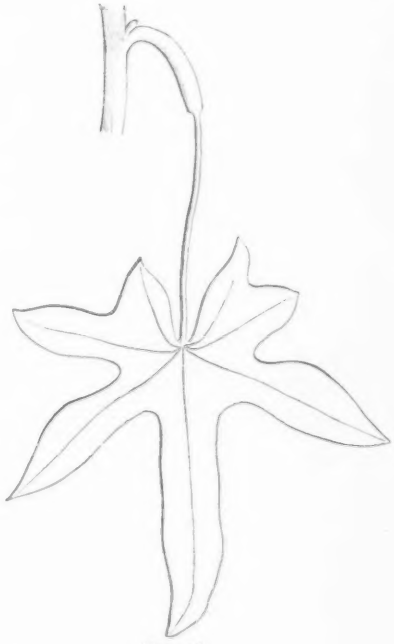

FIG. 16.

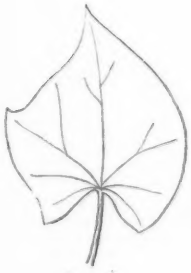

FIG. 13.

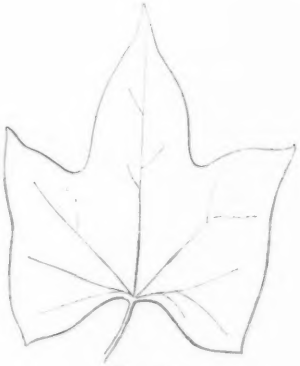

FIG. 15.

Disciphania Ernstii, Eichl. (After Eichler.)

gations on two young plants which had not yet flowered. These I procured early in 1882, and, most fortunately, both proved to be females. I had some lattice-work placed against the wall of an inner court-yard, and there the plants were left to over-run the whole wall, which is 4·5 metres by 4. As soon as the flowers

appeared I proceeded to examine them as carefully as possible, in order to see whether there were any male organs concealed either within or in their neighbourhood, but I searched in vain. In March 1883 the plants had covered the whole space allotted to them, and were then cut down. Branch after branch was once more submitted to the closest inspection, and the existing fruits, numbering 20, were collected. Of these 20 fruits I examined 5, and found that 3 had perfect embryos; 10 were sown in pots, but only 3 germinated; the remainder of the crop I still have in my carpological collection.

The plants soon began to sprout anew, and were again carefully searched whenever time and weather would allow it. They were cut off in December 1884, giving a crop of 54 fruits, which were disposed of in the following manner:—Examined, 10, 7 having perfect embryos; sown, 20; germinated, 9; kept in salt solution, 24.

The third period lasted till February 1886. Both plants were very vigorous, and had produced a large number of flowers, so that I collected no fewer than 137 fruits, of which 10 were examined (5 were good), 20 were sown, (8 germinated, the young plant being now about 6 inches high); the remainder will be sent to different botanical gardens within the tropics, in order that my experiments and observations may be repeated under the most favourable circumstances possible.

Since February the plants have grown a good deal; one is flowering and has already four fruits.

From the very outset of my observations I had noticed that these fruits appeared only on the thickened end of the flowering rachis, which is always the lowest part of the pendent inflorescence, as I have described in the first section of this paper. I cannot help thinking that this circumstance has something to do with the production of these fruits in general.

I must observe that the numbers 20, 54, and 137 of the fruits collected are not the total numbers of fruits produced by the plants in each period; for the earlier fruits fell off and got lost long before I gathered the crop. Whatever may have been this loss, it is certain that there was a constant and very notable increase of fruits. I am sorry I omitted counting all the flowering spikes at the time when the plant were cut down, so as to be able to compare their number with that of those bearing fruits, and to find out, at least approximately, whether both groups of numbers were reciprocally proportionate, or not so.

Be this as it may, *there is no denying the fact that many female plants produced in three successive years an increasing number of fertile fruits without the operation of any fertilising pollen from a male flower.*

The reader will remember that the nearest group of *Disciphania* is at a distance of about nine miles from Caracas. I am quite positive about this point, being well acquainted with the vegetation in the environs of the city. Now it is incredible that under such circumstances and in this species, which has neither showy flowers nor any perceptible smell, the pollination could have been effected by insects. It is furthermore certain that my plants of *Disciphania* are the *only* ones in Caracas, and that for this reason there is no specimen nearer to them than the few spontaneous ones which may grow in the ravine of Guarenas.[1] And even if there had been any pollination from outside, how is it that plants, which are known to be extremely prolific under normal circumstances, should produce such very scanty crops, although grown under the most favourable conditions?

For these different reasons I hold that the possibility of pollination from a male plant is entirely out of the question, and may fairly be discarded.

But it is likewise impossible that pollination could have taken place with material produced by the plants themselves, as no rudimentary male flowers, nor auxiliary stamens, have been discovered on them during the most scrutinising search in three successive years; nor was there ever found one single grain of pollen on the hundreds of stigmas that were inspected in the course of this investigation. I well remembered Karsten's criticism of Alexander Braun's paper on parthenogenesis in *Cœlebogyne*, and was, accordingly, very scrupulous to establish beyond all question the absence of any pollen-producing organs. I am fully convinced that I should have found them, if any had really existed.

In another respect I was unable to arrive at a positive result. I could not make sure whether the embryo is developed as an outgrowth from a cell of the nucellus, as Strasburger has found in *Cœlebogyne*, or whether it is the development of an unfertilised oosphere. As, however, the former case appears to be always connected with polyembryony, which does not occur in the seeds of *Disciphania*, it seems to me more probable that in this plant we have an instance of the second case, or of true parthenogenesis, certainly not as the rule and normal *modus* of reproduction, but as an exception, and a very rare one, a kind of makeshift of nature, as it were, when the co-operation of the fertilising material cannot be realised.

In Prof. Weismann's essay, "The Continuity of the Germ-Plasma," there is a chapter on the nature of parthenogenesis, which abounds in suggestions which, in my opinion, throw much light on the case under consideration. I quote the following sentence from Prof. Moseley's abstract in NATURE, vol. xxxiii. p. 157:—"If a special supply of nourishment reaches the germ-plasma, this increases in amount by growth, and thus obtains the mass requisite to start the ontogenetic process, with the result that parthenogenetical development takes place." Strasburger had already pointed out that an analogous result may be arrived at by specially favourable conditions in the supply of food, which counteracts the insufficiency of the germ-plasma. May we not suppose that something similar happens in *Disciphania?* Besides the herbaceous branches, the club-shaped rachis of the spicate inflorescences abound in proteids, and consequently there must be a specially abundant supply of food, which may have some particular influence on the growth of the ovary and its contents. And it is on those places we find precisely the fruits for which I claim a parthenogenetic origin.

Caracas, June 7 A. ERNST

P.S.—Since the foregoing article was sent to England, I have made the following observation, which, I think, gives additional strength to my view as to the probable cause of parthenogenesis in the case under consideration. On one of my plants I had noticed two rather short inflorescences (4 and 5 centimetres long), with but 3 and 4 flowers respectively, *but having a very much thickened, almost club-shaped, rachis*, which measured at the apex nearly 3 millimetres each way. The idea struck me that on these spikes very likely some fruits would appear, and I marked them out for the sake of further inspection. *My anticipations have been fully realised*, as on each of the two there is now one ovary increasing in size, measuring already 3 millimetres by 2, so that there is every reason to expect their final development.

At the same time I may mention that on the second plant, which has just begun to flower, I have found on one spike a *tetramerous*, and on another a *pentamerous*, female flower; both spikes were very small, and had only two flowers. A. ERNST

Caracas, June 23

[1] It is interesting that the second species of *Disciphania* (*D. lobata*, Eichl.) appears likewise to be an exceedingly rare plant, as may be inferred from an observation of of Prof. Eichler's, in the article mentioned before.

OUR ENGLISH TEMPERATURES

A PERIOD of warm weather, lasting for three weeks, set in over the whole of the United Kingdom about August 24, and continued until September 14, over nearly

the whole country. Throughout this period there was no part of England in which the temperature was not above the average in each week, as shown by the returns issued by the Meteorological Office.

The persistent low temperature which preceded this warm weather, and which had so long continued, was described in NATURE for August 12 (p. 341). This cool weather continued till August 23, when, fortunately, the conditions entirely changed, and a warm spell of exceptional length for either summer or early autumn set in. It is necessary to go back to February 1885, eighteen months ago, before we find so long a period with the temperature above the average, and since that time there have not even been two weeks in succession which were warm generally over the whole country.

In recent years there has been but very little really settled warm weather during the three months July to September. Last year there was only one week, ending July 27, which could in any way be termed warm generally over the country during the whole period of three months. In 1884 finer weather was experienced, and there were four consecutive weeks, ending August 25, with the temperature above the average over Great Britain; there was also a period of three consecutive weeks, ending September 29, with warm weather, and two consecutive weeks ending July 14. In 1883 there was only one week, ending September 24, in which the temperature was above the average over the whole of the British Islands, but there were other weeks during the three months in which the temperature was high in several districts; there was, however, no continuous warm weather. In 1882 the week ending August 14 was the only instance with the temperature generally above the average, and in this period a deficiency was shown in the East of England. In 1881 there was not a single week in the three months with the temperature generally above the average. In 1880 there were five consecutive weeks, ending September 13, with the temperature above the normal value, and warm weather was also enjoyed in the week ending September 27. In 1879 temperature was continuously low throughout the period, and the deficiency generally amounted to several degrees; there was not a single district over the whole of the United Kingdom with the temperature above the mean for a single week.

From this it is seen that during the last eight years there were but two years, 1880 and 1884, which can in any way compare with this year for warm weather during the three months referred to, and in the remaining five years there was not a longer period than a single week with continuous warm weather.

The varying conditions with which warm weather occurs in England is exceedingly puzzling. This year it has accompanied weather of a cyclonic type, and has changed to cooler weather with the anticyclonic conditions which set in about September 14. To attempt an explanation of these conditions from observations for our own limited area, or even from the observations over Europe, would be but labour lost. For such an inquiry it is necessary to wait the issue of the synoptic charts for the northern hemisphere which are compiled by the United States Signal Service from the international synchronous meteorological observations. Doubtless a careful study of these will throw some light on the cause of the prolonged irregularities in the distribution of temperature.

CHAS. HARDING

NOTES

THE American Association at the Buffalo meeting unanimously passed a resolution expressing its gratification at hearing of Dr. Gould's proposed revival of the *Astronomical Journal*, and its good wishes for its success.

MR. G. T. PRIOR, B.A. of Magdalen College, Oxford, has been appointed an Assistant in the Department of Mineralogy in the British Museum, to fill the vacancy caused by the death of Dr. Flight. The two vacancies in the staff of the Zoological Department occasioned by the resignation of Mr. E. J. Miers on account of ill-health, and Mr. J. J. Quelch, appointed to the curatorship of the Demerara Museum, have been filled by the nomination after competitive examination of Mr. C. J. Gahan and Mr. Randolph Kirkpatrick. Mr. C. G. Crick has lately been appointed an additional assistant in the Department of Zoology.

WE regret to learn of the death of Dr. Clement Mansfield Ingleby, at the age of sixty-three years. The death is also announced of Admiral Bedford Pim.

WE regret to note the death of Prof. H. A. Bayne, Ph.D., of the Royal Military College, Kingston, Ontario, Canada. Dr. Bayne was a native of Nova Scotia. He graduated in Arts at Dalhousie College, Halifax, N.S., and afterwards spent five years in the special study of chemistry under Wiedemann at Leipzig, Bunsen at Heidelberg, and Dumas at Paris, taking his Doctor's degree at Heidelberg. Returning to his native land he first engaged in organising the Scientific Department of the Halifax High School, acting at the same time as Lecturer on Chemical Analysis at Dalhousie College. In 1879 he was appointed Professor of Chemistry at the Kingston Military College, which had just been founded. His work at Kingston was very onerous, and during the first few years of his professoriate he found little time for original research. At the last meeting of the Royal Society of Canada, of which he was a Fellow, he read a paper of practical value on chemical tests of the purity of silk. He had begun in Germany a series of experiments on the properties of certain of the rarer metals, in which he had been interested by Bunsen; and he hoped to continue them when leisure came. But he has been cut down at the very threshold of his work.

THE annual Exhibition of the Photographic Society was opened to the public on Monday.

NEWS of earthquakes and volcanic eruptions continues to arrive from all quarters. The North American earthquakes have not ceased. Three slight shocks were felt in Summerville on September 28, and at night several more occurred. From various parts of Central Germany, principally Thuringia, news arrives showing that in the night of the 27th, or morning of the 28th ult., there was a series of more or less violent shocks of earthquake. At Gera and other places in Thuringia, the windows, doors, cupboards, and other movable articles of furniture, were violently agitated, shaking and rocking to and fro. A despatch received at New York on Tuesday from Mexico states that a high hill in the vicinity of Chimalapa has been completely riven in two by the action of subterranean forces. The volcano of Colima, in Mexico, is in a state of eruption for the third time within a year. Information has been received at Lerwick stating that two shocks of earthquake had been experienced at Baltasno, Unst, Shetlands, on Monday night. The first shock was felt at eleven, the other two hours later. Several people were roused from sleep by houses trembling and china rattling. Both shocks lasted several seconds, but no damage occurred to property. A telegram from Melbourne, October 5, states that a volcanic eruption has occurred in the island of Niapu, in the Tonga group. Two-thirds of the island are completely covered with volcanic dust. Mount Pabloff, 300 miles south of Kodiak, in Alaska, is in eruption.

MR. S. K. SEKIYA writes from the Imperial University, Tokio, Japan:—"On July 23 quite a destructive earthquake visited Shinano, Echigo, and the neighbouring provinces, over-

throwing several houses, forming fissures on roads and hill-sides, and causing severe damage to household property. The shock also stopped the flow of a hot spring at Nozawa. The part most severely shaken lies among the mountainous district some 3000 feet above the sea, with the famous active volcano of Asama, besides many extinct ones—an interesting case in Japan, as most of the larger earthquakes extend along the sea-shores."

A RECENT number of the *Japan Weekly Mail* contains a short account of a night ascent of the active volcano Asamayama. The party left Karnisawa in the afternoon, and commenced the ascent from the eastern side about sunset. The sky was perfectly clear, and the summit was reached an hour before midnight. The wind, blowing from the south, carried the sulphurous vapour away to the northwards, and thus the ascent was made less uncomfortable. The party saw quite to the bottom of the crater, which presented the appearance of a furnace filled with glowing coals. The sound of the roaring, hissing, and bubbling is described as loud and awful. The walls of the crater are of a light-brown colour, and are composed of successive layers marked out with striking regularity like the seats in an amphitheatre. Allowing ten of these layers to each interval of 20 feet, the depth from the surface to the incandescent matter would appear to be 200 feet. The periphery of the crater is about half a mile, although the Japanese calculate it at two miles and a half.

MR. PERCY SMITH, Assistant Surveyor-General of New Zealand, has made an ascent of Tarawera, where the eruption recently took place. He found the mountain split across, the crack in some places being 5 chains wide. Mr. Smith is now making a minute examination of the district.

ACCORDING to intelligence received at Hamburg, advices from the waters of Spitzbergen now confirm the former news from Iceland and from the mouth of the Pechora, on the Siberian coast, to the effect that the ice in the Arctic Sea has this year extended unusually far southwards. Spitzbergen, the sealers report, was found to be surrounded with an ice-belt 5 to 8 miles broad, and there was firm pack ice from Hope Island to Forland, about 56 miles. The great bays on the Storfjord, Hornsund, Bellsund, and Isfjord were quite inaccessible, and the sealers, after waiting all the spring and most of the summer, returned at the end of August, as there was no prospect of the Polar ice dividing.

PROF. ALEXANDER, who has filled the Chair of Engineering at the Imperial College of Engineering, Tokio, for a number of years past, and who is about to leave the country, has been presented by his colleagues, past and present, with a handsome pair of bronze vases, inlaid with silver, and with an address. The graduates of the college on the same occasion presented him with four pieces of Japanese bronze work. The documents accompanying these presents show that the retiring Professor is much regretted by those whom he leaves behind—colleagues as well as pupils.

ACCORDING to the Report of the Superintendent of the Government Museum at Madras for the past year, the interest of the people in that institution is on the increase. The number of visitors is considerably larger, this being especially noticeable in the case of women and girls, which probably indicates some relaxation of the custom of seclusion, and an increasing interest on the part of Indian women in things beyond, and different from, their ordinary duties. In the work of the Museum there seems to have been an advance in almost every direction. The materials for catalogues of the departments of ethnology and antiquities were collected. Mr. Davison, the well-known Indian ornithologist, was engaged at the suggestion of the Governor for a period of six months to make a collection of South Indian birds for the Museum, and when this has been done a catalogue of the birds will be taken in hand. Similarly in other departments the work of the institution has been progressing. The Superintendent notes that the native visitors object to the drinking-fountain in the grounds, owing to the resemblance that the discharge of water from the mouth of a stoneware lion's head has to the act of vomiting!

THE total railway mileage of the United States is now 130,334, of which 12,116, or 9·2 per cent., is narrow gauge, and 187 broad gauge (5 feet and over). In view of the numerous breaks of gauge, transfer-apparatus enabling quick and easy change under car-bodies of trucks made for one gauge to trucks made for another is a desideratum. A committee of the Franklin Institute has just highly commended Ramsay's system for the purpose. In this, when, *e.g.*, a broad-gauge car is to be transferred to a narrow-gauge line, the car is brought with the aid of side trucks and cross bars over a depressed piece of line having both gauges, and an inclined approach and exit; and it there exchanges one kind of truck for the other. It may be noted that the narrow-gauge system in the United States, far from having "seen its best days," is constantly resorted to in the development of mountainous and sparsely populated districts, California taking the lead in this respect.

WE learn from a French source that Prof. Place, of the Cavalry School of Saumur, has recently applied electricity with great success to horses which prove refractory while being shod. It is known that a vicious beast will often give much trouble in the operation of shoeing, and may even have to be bound and made to lie down. M. Place's method renders it at once tractable, and permanently cures its aversion to the forge. The electric shock is given through a bridle of special form, from an induction-coil actuated by a dry pile.

THE effect of muscular exercise on the temperature of the body has been recently engaging the attention of M. Mosso in Italy. In thermometrical relations the nerves, he concludes, have much greater action than the muscles. Strong emotion will raise the rectal temperature of a dog 0°·5 to 2°, and the same with man. Pain has the same effect. During a walk of two days, M. Mosso observed that his temperature was not in proportion to the work done by his muscles. When dogs rest after long fatigue, one observes that their heat sinks below the normal level, though their muscular exertion has been great. Again, take the evidence of strychnine and curare; the former of which affects the nerve-centres, while the latter paralyses the muscular system. A frog poisoned with curare falls into complete paralysis, with lowering of heat. If a few milligrammes of strychnine be then injected, the paralysis does not cease, but the temperature immediately rises. Internal temperature, then, seems to depend chiefly on the nerve-centres and their greater or less excitation.

WE have received the "Proceedings and Addresses" at the Sanitary Convention held in March last in Howell, Michigan, under the direction of the State Board of Health. The various papers are of a very plain and practical character, free for the most part from technicalities. We have read with especial interest, in view of recent discussions in this country, Prof. Barnes's address on the sanitary conditions and needs of American schools. Speaking of the complaint in England that owing to the requirements of the present code the children of the very poor whose food is bad and insufficient become afflicted with sundry dangerous nervous disorders, Prof. Barnes says that if this be true for England, it certainly is not for the United States. But there as well as here there are critics who hold the system of education to be responsible for all the ills of youth. Prof. Barnes shows that this is absurd. Adequate heating and ventilation he regards as the chief respects in which American

schools are lacking. Indeed it appears from the papers that the other public buildings of the State of Michigan share these defects with the schools; the court-house, according to Mr. Waters, is little better than a death-trap, and the others are far from being what they should be.

We have received the *Report and Proceedings* (vol. i. part 1) of the Bristol Naturalists' Society. The former is very satisfactory, as it shows an increase in the membership and an increased attendance at the meetings. The finances, too, are in a sound state, with the exception of the special library fund, which appears to be in debt. The Council urge the formation of similar Societies in neighbouring towns, and their affiliation to the Bristol Society, "for so much can be done for science by mutual intercourse and encouragement." The contents of the *Proceedings* (the part being profusely illustrated) reach a high standard. Prof. Lloyd Morgan publishes the third and fourth parts of his "Contributions to the Geology of the Avon Basin," dealing with the Portbury, Clapton, and Portishead districts. Mr. Wilson, Curator of the Bristol Museum, gives the history of the exploration of the bone-cave or fissure in Durdham Down, from which the series of mammalian remains in the Bristol Museum were obtained. Lists are given of the remains found, and of the principal publications referring to them. Mr. Bucknall publishes Part 9 of his "Fungi of the Bristol District," while Mr. Griffiths writes on the *Cicada septemdecim*, "the seventeen-years' locust" of America. There are several other more general papers. At the end is the continuation of the "Flora of the Bristol Coal-Field," edited for the Society by Mr. J. W. White, the compilation of which was commenced seven years ago, and which has continued steadily ever since. One thousand and three species have already been treated as inhabitants of the district. The present part, which is the sixth, treats of *Glumiferæ Gymnospermæ* and *Cryptogameæ Vasculares*. It is proposed to begin at once revising the earlier parts with a view to the preparation of a second edition, and an appeal is made to members and friends to aid in making the work as complete and accurate as possible. It is hoped in this way to lay before the Society a thoroughly worthy account of the botanical wealth of Bristol.

The Otago Acclimatisation Society have, during the past year, been highly successful in their fish-culture operations in New Zealand. The utmost is being done to naturalise Salmonidæ to the waters of that country, and from all accounts the experiment is likely to succeed. The Society are about to try the experiment of retaining salmon in fresh waters at Marshall's Creek with a view to testing the assertion that it is not a physiological necessity for fish to repair to the sea to render them capable of reproduction.

Newcastle-upon-Tyne Free Library, though suffering from a fire which arose from the flue of a sunlight in the reference room getting overheated, and caused both reference and issue department to be closed for many days, nevertheless records general prosperity, boasting at the same time the issue of the smallest percentage of fiction of twelve of the largest free libraries in England. A new catalogue of 10,000 books added to the lending department during the five years and a half the library has been open, and another of the juvenile department, are being prepared to meet the want that must be so urgent in a library where crowded applicants can gain knowledge of the treasures offered them by no other channel. Only thirteen volumes, not worth 1*l.*, have been lost during the same length of time, not reaching 1 in 100,000 issues; in the juvenile department only 1 in 185,000; and during the past year not one volume! Yet, as if this were not satisfactory, the Committee have decided to make every borrower (*i.e.* over 8500 persons) renew his ticket yearly, instead of once in five years, for the sake of correcting addresses. Balancing this enormous aggregate of trouble to the public, *plus* that of the library officials in carrying it out, against that of the latter in tracing borrowers who have removed without signifying the same to them, we cannot think that this shows either the wisdom of the serpent or the harmlessness of the dove! Science and other educational classes, so aptly carried on under a free library committee, were attended by 141 students in 1884-85, and, we are glad to see, by 186 in 1885-86. Three branch reading-rooms, however, we note with surprise, were not attended sufficiently to make it worth the expense of keeping them open.

The intelligent community of Watford, to whose various clubs and classes, all working together under one committee, we called attention some time ago, find co-operation so successful that they have published a bound hand-book of 160 pages, containing, besides a library catalogue with supplementary lists down to September 1886, all the other varied information which they have to lay before the public. The principal item to notice is that they have succeeded in adding the University Extension lectures to the numerous branches of art and science already under their care. The name of "The Free Library 'College' of Science, Art, Music, and Literature" has now been adopted, as denoting the "collection" of schools of which it consists. Sir John Lubbock has accepted the new office of President of it, and on Tuesday, the 28th ult., he delivered an opening address. He chose the subject of ants and their ways; and, since natural history is among the scientific pursuits of the college, it was both a specially fitting and, we need not add, a generally interesting subject. The nucleus of all the various work carried on at Watford is a free library rate which even now only brings in 240*l.* a year. Such success should therefore encourage such smaller towns as cannot find separate committees each with its own work and expenditure also.

Amongst the papers read at the International Congress of Orientalists at Vienna were one by Dr. Stein on the Hindu Kush and Pamir in Iranian geography, and one by Prof. Kuhn on the Indian dialects spoken in the Hindu Kush. Prof. de Lacouperie also read a paper on the aboriginal languages of China.

Messrs. Spon have in the press: "Metal Plate Work, its Patterns and their Geometry," by C. T. Millis, M.I.M.E.; "A Practical Hand-Book on Pump Construction," by Philip R. Björling; "Spons' Mechanics' Own Book" (second edition); "Quantity Surveying," by J. Leaning (second edition, revised and enlarged); "A Treatise on Secondary Batteries," by Prof. Silvanus P. Thompson, D.Sc., B.A.

The additions to the Zoological Society's Gardens during the past week include a Mona Monkey (*Cercopithecus mona*) from West Africa, presented by Mr. W. P. Hewby; a Malbrouck Monkey (*Cercopithecus cynosurus*) from East Africa, presented by Mr. Lionel R. Crawshay; a Rough Fox (*Canis rudis*) from British Guiana, presented by Capt. J. Smith; a Hairy-rumped Agouti (*Dasyprocta prymnolopha*) from Guiana, presented by Mrs. Otto Fell; a Common Hedgehog (*Erinaceus europæus*) British, presented by Madame Tina Mazzoni; two Moorhens (*Gallinula chloropus*), British, presented by Lord Moreton, F.Z.S.; a Horned Viper (*Viper cornuta*) from South Africa, presented by Mr. C. B. Pillans.

OUR ASTRONOMICAL COLUMN

Personal Equation in Observations of Double Stars.—M. Bigourdan, of the Paris Observatory, has taken the above as the subject of his Thesis for the degree of Doctor of Physical Science. In an historical review of the subject he refers to the labours of Dawes, W. Struve, O. Struve, Dunér, O. Stone, F. R. Helmert, and T. N. Thielo. He dwells particularly on the researches of

O. Struve, who has persevered so assiduously in the observations of artificial stars initiated by W. Struve. M. Bigourdan shows, however, that by this method it is not possible to eliminate the errors due to the instrument itself, and especially to the object-glass. But it is M. Bigourdan's opinion that it is difficult, if not impossible, to avoid the employment of artificial stars in determining personal equation in measures of double stars, and he has accordingly devised an apparatus, which he describes as simple and of moderate cost, by means of which observations of artificial stars can be made at any time, and which he considers to be free from the objections which have been urged against Struve's method. In this apparatus the plate pierced with holes which form the images of the "stars" and the viewing lenses, are carried by one tube which is movable round a horizontal axis, so as to vary the inclination of the eyes with respect to the horizon; the pierced plate rotating in its own plane so as to vary the angles of position of the artificial coupler. M. Bigourdan gives in the Thesis a great number of measures made with this instrument, deduces a formula for his personal equation in position-angle, and shows how the application of the corrections deduced from it improves the observations.

PUBLICATION DER ASTRONOMISCHEN GESELLSCHAFT, No. XVIII.—This is a paper by Herr Romberg, of Pulkowa, containing the approximate positions of stars whose places (chiefly as comparison-stars for observations of planets and comets) are given in vols. lxvii. to cxii. of the *Astronomische Nachrichten*, arranged in order of right ascension and reduced to the epoch 1855. This work is a continuation of a similar one executed by Schjellerup for vols. i. to lxvi. of the same periodical, forming No. VIII. of this series of publications, and is similar in form to it. The right ascensions are given to seconds of time, and the declinations to tenths of a minute of arc, and Herr Romberg expresses a hope that his Catalogue may be useful not only as an index to such a large number of observations of stellar positions, but also as a groundwork for accurate determinations of the star-places. The total number of stars in the Catalogue is about 8000, the great majority of them being fainter than the seventh magnitude.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 OCTOBER 10-16

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on October 10

Sun rises, 6h. 17m.; souths, 11h. 47m. 1·6s.; sets, 17h. 17m.; decl. on meridian, 6° 43′ S.: Sidereal Time at Sunset, 18h. 34m.

Moon (Full on October 13) rises, 16h. 37m.; souths, 22h. 19m.; sets, 4h. 11m.*; decl. on meridian, 4° 7′ S.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian ° ′
Mercury ...	7 7 ...	12 20 ...	17 33 ...	9 57 S.
Venus	4 56 ...	11 0 ...	17 4 ...	0 4 S.
Mars	10 46 ...	14 49 ...	18 52 ...	21 50 S.
Jupiter... ...	6 11 ...	11 46 ...	17 22 ...	5 29 S.
Saturn... ...	22 18* ...	6 20 ...	14 22 ...	21 22 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Occultations of Stars by the Moon (visible at Greenwich)

Oct.	Star	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image ° °
12 ...	*f* Piscium	5½ ...	23 58 ...	0 15† ...	40 19
14 ...	μ Ceti	4 ...	18 11 ...	19 1 ...	46 272
16 ...	θ^2 Tauri	4½ ...	18 52 ...	19 36 ...	98 216
16 ...	θ^1 Tauri	4½ ...	19 1 ...	19 27 ...	127 186
16 ...	80 Tauri	6 ...	19 25 ...	20 4 ...	24 287
16 ...	81 Tauri	5½ ...	19 36 ..	20 20 ...	32 279
16 ...	B.A.C. 1391 ...	5 ...	20 5	near approach	155 —
16 ...	85 Tauri	6 ...	20 5 ...	20 59 ...	53 255
16 ...	Aldebaran ...	1 ...	22 37	near approach	155 —

† Occurs on the following morning.

Variable Stars

Star	R.A. h. m.	Decl. ° ′		h. m.
U Cephei	0 52·2 ...	81 16 N. ...	Oct. 14,	5 32 *m*
S Cassiopeiæ ...	1 11·3 ...	72 1 N. ...	,, 10,	*M*
λ Tauri	3 54·4 ...	12 10 N. ...	,, 10,	3 1 *m*
			,, 14,	1 53 *m*
U Monocerotis ...	7 25·4 ...	9 32 S. ...	,, 13,	*m*
U Coronæ	15 13·6 ...	32 4 N. ...	,, 12,	18 52 *m*
			,, 16,	5 43 *m*
U Ophiuchi	17 10·8 ...	1 20 N. ...	,, 13,	3 39 *m*
		and at intervals of		20 8
W Sagittarii ...	17 57·8 ...	29 35 S. ...	Oct. 13,	2 0 *M*
U Sagittarii... ...	18 25·2 ...	19 12 S. ...	,, 11,	19 0 *m*
			,, 14,	19 0 *M*
R Scuti	18 41·4 ...	5 50 N. ...	,, 12,	*M*
β Lyræ... ...	18 45·9 ...	33 14 N. ...	,, 14,	19 0 *M*
R Lyræ	18 51·9 ...	43 48 N. ...	,, 13,	*M*
η Aquilæ	19 46·7 ...	0 43 N. ...	,, 11,	22 0 *M*
V Cygni	20 37·6 ...	47 44 N. ...	,, 15,	*M*
T Capricorni ...	21 15·7 ...	15 38 S. ...	,, 13,	*M*
δ Cephei	22 24·9 ...	57 50 N. ...	,, 12,	19 0 *m*
S Aquarii	22 51·0 ...	20 57 S. .	,, 12,	*M*

M signifies maximum; *m* minimum.

GEOGRAPHICAL NOTES

AT a recent meeting of the Anthropological Institute in connection with the Colonial and Indian Exhibition, Mr. Pryer, of the Civil Service of British North Borneo, read a paper on the natives of this region. The main race, the Dusuns, are in all probability descendants of a mixed aboriginal and Chinese ancestry, and as we come nearer to the coasts the sub-tribes mix and blend with each other and with aliens, till on the east coast there is very little of the native type left at all, a race rapidly springing up there of very cosmopolitan origin. On the west coast there are more natives and fewer aliens, but much the same thing is occurring there on a smaller scale. It is difficult to say where the Dusun ends and the Dyak proper begins; the former were at one time head-hunters, but they are now settling down under the North Borneo Company quietly to rural toil. They are thriving and increasing, and there is no fear of their melting away and disappearing, as so many races have done when brought in contact with the white man. The same may be said of the sea-coast races, especially of the Bajans. The Sooloos are the principal fishermen, and, like the rest, are now settling down to a more quiet and orderly life. The first true tribe of the interior arrived at from the east coast is the Booloodoopy, a somewhat singular people, many of them having strangely Caucasian features, or, at all events, departing largely from the ordinary Mongolian type. Mr. Pryer describes several other tribes of the interior, and he inclines to the idea that the Chinese type is far more predominant in Borneo, even amongst the Dyaks, than has generally been supposed. He does not think that the Chinese went over in bodies to North Borneo, but rather that in the long course of Chinese trade with and settlement in the island, a slow and steady infiltration of Chinese blood, though not of Chinese speech or manners generally, took place.

AT a late meeting of the Paris Geographical Society M. Hamy made a communication on an exhibition of collections from the French possessions in West Africa in the Jardin des Plantes, contributed by the Museum of Natural History and that of Ethnography. The exhibition, he said, was composed of two sections, one devoted to natural history, the other to ethnography. The first showed that the countries were rich in iron and copper, which had ever furnished the natives with indispensable implements and utensils. Trees and various plants abound, and game is not rare. Numerous races live and have lived in these regions. The exhibition shows how they are at present distributed in West Africa. There are four groups of Negroes:—(1) The Negrillos or Pygmies, the most western race. They live now only in small scattered colonies in the most unhealthy spots, such as the estuary of the Ogwe, and the interior of Mayonbo; they are called Okoa, Bongoa, Bakké-bakké, Babonko, &c. (2) The second group is brachycephalous, of middle height, and lives principally on the right bank of the Lower Congo, but particularly on the Loango. They work in iron, and are far advanced in the mechanical arts. (3) The Mpongos, or people of the Gaboon, who have been in contact

with Europeans since the end of the sixteenth century. M. Hamy referred in detail to the manners and industry of this people. (4) This is a slightly heterogeneous group, consisting of the Obambas, Ondumbas, &c., who live in the neighbourhood of Franceville. In conclusion the speaker referred to the interest of ethnological research in relation to the movements of peoples on the earth's surface. Here, he said, ethnography is especially bound up with geography.

THE Portuguese explorers, Col. Serpa-Pinto and Lieut. Cardoza (according to the *Colonies and India*) recently left the Cape Colony for Lisbon. These gentlemen have accomplished a most important scientific exploration in the Lakes region. Leaving Mozambique. they proceeded by land to Ibo, correcting many errors that had crept into the charts. From Ibo they advanced to Nyassa at the head of an Expedition 800 men strong, making as they went a geodetical triangulation of the country, using instruments of great precision. Col. Pinto, in consequence of a dangerous attack of illness, was obliged to leave the Expedition in Mebe's country, of which he had made a geological survey, occupying a long time. Lieut. Cardoza, who had been blind for fifty days, happily recovered his sight in time to take the command of the Expedition, continuing the work to Nyassa, from whence he went to Shirva and Blantyre, and by a new road to Quilimane. The whole party suffered from hunger on the way; all the dogs died of starvation, and the men narrowly escaped the same fate. The Expedition was accompanied by 200 Zulus, who rendered splendid services, being conspicuous for their courage and devotion. Besides their scientific work, the first of the kind done in that part of Africa, the leaders of the Expedition extended the Portuguese dominion over all the important chiefs visited during the journey, lasting twenty months. Everywhere the Expedition was heartily welcomed by the natives, the only place where the Mission was not cordially received being, it is said, the Blantyre Mission Station.

THE September issue of the *Scottish Geographical Magazine* contains a paper by Prof. Meiklejohn on the history, poetry, &c., in geographical names. Mr. Murray, of the *Challenger* Expedition, reviews the existing state of our knowledge of the Antarctic regions *à propos* of the project for exploring them. The Council have unanimously resolved to support any movement having for its object the careful exploration of the Antarctic regions, "as being certain to result in large and important accessions to our knowledge in geography, oceanography, meteorology, and other branches of physical science." They think the expedition should be undertaken at Government expense, but the co-operation of Australasian Governments might be invited. They suggest a conference of delegates of the leading scientific Societies to draw up a memorial to the Government on the subject.

ACCORDING to the latest intelligence received at Zanzibar from the interior of Africa, Dr. Wilhelm Junker, the African traveller, was at Msalala, south of the Victoria Nyanza, and was about to start for Zanzibar. Emin Bey was still at Wadely, and was in urgent need of supplies of ammunition and stores. The King of Uganda had murdered all the English and French converts, and the missionaries were in great danger and had asked for assistance.

PROF. BLUMENTRITT contributes to the last number of *Globus* (vol. l. No. 14) an interesting article on the Manguians of the island of Mindoro, in the Philippines, based on a Spanish work by Don Morera on the geography and natural history of that archipelago. Next to Luzon and Mindanao, Mindoro contains the greatest number of wild tribes. Those which live on the coast and along the banks of the rivers are known under the general name of Manguians, while the Bangot inhabit the plateaus, and the Buquil and Beribi have their villages amongst the high mountains of the interior, but these names vary greatly in different parts of the island. They exhibit a mixture of various races. Besides the Malays, there is Negrito blood in the Buquils, and in some places traces of Chinese descent also. Prof. Blumentritt confines himself to describing the manners, customs, dress, &c., of the Manguians. Incidentally, however, the paper tends to show the enormous complication and difficulty of ethnological questions relating to the Philippine Islands. The constant mingling of different races from China, Malaya, and parts of Melanesia and Polynesia has created a mixture of which the component parts are almost undiscernible. The vast variety of names given to tribes, which rarely mark any ethnical distinction, and which sometimes are given to the members of the same tribe, add to the confusion.

NOTES ON VESUVIUS FROM FEBRUARY 4 TO AUGUST 7, 1886

IN NATURE (vol. xxxiii. p. 367) I gave a description of the changes that had taken place in Vesuvius during the preceding months, and of the eruption of February 4. The lava that issued on that occasion continued to flow in abundance until the 11th, forming a brilliant streak on the northern slope of the cone. After that date the output of fused rock varied at intervals till about the end of the third week in March, when the outflow stopped.

On April 21, at about 5 p.m., lava rose from that portion of the fissure crossing the great crater plain on its south side, and which was the one by which the eruption of May 2, 1885, had taken place. The quantity that oozed out was comparatively small, and sufficed only to flow down the side of the great cone for about 100 metres, so as to just cover the point of exit of the lava that had issued from the same fissure in the spring of 1885. The new lava piled itself up into a kind of boss, and thus soon plugged its own passage.

A few days after, that is, on April 27, a new outburst occurred, again at a weak point—the upper limit of the fissure of 1881–82, above the buttress of lava formed subsequent upon that eruption. This was sufficient to carry off the overflow for some weeks. Slight variations, such as are constantly going on, were observable in the activity of Vesuvius and the outflow of its lava during the whole of the month of May. During the eruption of Etna, Vesuvius did not show the slightest sympathy—just what we should expect when our conception of a lateral outburst is that it is simply a mechanical result of changes that proceed in the upper part of the volcanic chimney, and usually of the mountain itself.

During the month of June the outflow of lava on the eastern side persisted, adding to the great boss, hump, or buttress formed during the years subsequent to the eruption of 1881-82. Owing to the height of the lateral outlet, and probably also from its narrowness, the level of the lava column in the chimney was very high, and, as a consequence, the numerous pasty lava-cakes added much to the size of the eruptive cone, which grew so rapidly during the month as to cover all the old remnants of crater-rings except a small portion of the northern rim of that of 1881–82. On June 29, when I visited the crater, I found a long continuous fissure extending right across the great crater plain in a westerly direction, and emitting an abundance of hot air, HCl, with vapour of chlorides, which were deposited in feathery bunches on the cooler edges of the fissure. This fissure no doubt corresponds to the upper limit of a radial dyke, as did the one existing for many months previous to the eruption of May 2, 1886, and probably does, like that one, indicate the direction of an eruption at some future time. When such an eruption takes place it will be unpleasant for the funicular railway, which, although a little south of the line of fissure, would be within reach of the outburst. In the above-mentioned visit it was possible to watch the eruptive mouth for some time from the edge of the cone of eruption, and to take an instantaneous photograph of it amidst an exciting bombardment of stones, not dangerous for one's self, but unfavourable to an inactive photographic camera. Unfortunately an accident happened to the negative, but I have since been successful in obtaining a permanent record of the eruptive mouth, though hardly such a successful picture. The diameter of the main vent was about 3 or 4 metres, and nearly circular.

The crater was again visited on June 5. but no marked change had taken place, and lava was always issuing on the east side and flowing first to one side and then to the other, always adding to the great buttress.

The cone of eruption, owing to its great increase of size during the last thirteen months, formed a very conspicuous mound, perched as it were on the flattened summit or crater plain of 1872, which truncates the great cone of Vesuvius. On June 28 it was observable from Naples that the cone was falling in, and the spine or boss forming the northern boundary of the crater of eruption had in part disappeared, and owing to the plugging of the passage the smoke only escaped in puffs. This crumbling in of the crater walls was no doubt due to the loss of

support of the column of lava within the chimney. This lowering of level probably produced the extension outwards of the eastern dyke, and the lateral outlet of lava was consequently lowered. This was confirmed by the much increased outflow of lava coincident with the falling in of the cone.

During the first week in July the volcano appeared from Naples to be very quiet; indeed, less vapour was escaping from the summit than at any time during the last seven years. From time to time the vapour was, from the gradually increasing pressure, able to burst its way through the loose materials that choked the outlet, when a puff of smoke would be visible of a dark purplish-black colour, due to its being charged with volcanic ash derived from the churning up and trituration of the lava fragments, scoria, and lapilli it had to traverse in its escape. At the same time a slight reflection was to be seen at night, indicating that the lava surface, although lowered, was not so to any great extent.

On this day, July 8, the lava which had always been gradually advancing, had crossed the southern end of the Val d'Inferno, and flowing down one of the wooded ravines on the property of the Prince of Ottajano, where it destroyed a number of trees, it continued its course, overwhelming some vine-gardens. On July 12 the number and quantity of the black smoke puffs was very great, and the crater was in the full ash-forming stage, and towards night the vent had been considerably cleared, so that the reflection was well marked. The next day the smoke issued freely and uncharged with ash. The change that took place on the 12th was no doubt due to the lava rising in the chimney consequent upon the lateral outlet getting choked; as on the 11th, the abundant flow of lava became very much diminished.

On July 20 the puffs of dark smoke again appeared, indicating a return of the crumbling in of the crater; this was again due to the lowering of the lava level, and, as was expected, the fluid rock issued in great abundance the following day, again destroying trees and vine-gardens. The next day the lava was still flowing in abundance, so as to form a bright streak on the slope of the great cone. The outflow continued to gradually diminish until the 30th, the crater above remaining inactive. On the latter date, however, the lava rose again sufficient within the chimney to cause the vapour to find a passage through the materials choking the main vent, so that on that day the puffs of black smoke were again abundant, and accompanied by the ejection of partially triturated subangular old lava and scoria fragments. In the evening bright bursts were well marked, showing that the vent was again cleared. The two following days the volcano maintained the third degree of activity (*Rep. Brit. Assoc.*, 1885, p. 395).

During the first week of August the lava again flowed rather freely from the mountain's side, whilst from its summit hardly any vapour escaped except from time to time a puff of black smoke. On August 7 a visit was paid to the crater. The cone of eruption has been reduced in height about 30 metres, and its remnants form a low crater ring inclosing a crater of oblong form having a diameter of about 80 × 60 metres. Its greater axis lies in a line from about E.S.E. to W.N.W., and its bottom is double, so that it seems to result from two craters closely overlapping each other. The crumbling-in process was still going on, and the trituration of the loose stones and the charging of the vapour puff by the ash or sand could be watched from a distance of a few yards. I was successful in obtaining two ordinary and two instantaneous photos of the interior of the crater, only the eastern half of which, however, was active.

The principal facts that may be gathered from the study of the phenomena of Vesuvius during these few months are rather confirmations of what the author has described as the mechanism of lateral eruptions, which may be summed up thus. The lowering of lava level within the chimney due to a lateral outlet removes the support the former gave to the walls of the crater and vent, which in consequence tumble in and choke more or less of the main outlet. Next the vapour contained in the lava may be compelled to escape laterally, but has a natural tendency not to do so, but rather to seek its path straight upwards. If the lateral outlet becomes choked, the lava immediately commences to rise in the chimney, and the escaping vapours burst through the loose materials in the chimney in puffs, grinding and triturating them, carrying upwards their dust, which tints the smoke of a dark colour, and, falling around the volcano, constitutes one of the forms of "volcanic ash," the chemical composition of which represents that of all the rocks triturated *plus* the saline substances condensed from the smoke. If one walks across this ash when damp, one may notice the immediate plating of their boot-nails with copper, showing the abundance of the chloride of that metal. H. J. JOHNSTON-LAVIS

THE ADELAIDE BOTANIC GARDEN AND GOVERNMENT PLANTATION

THE report of Dr. Schomburgk on the progress and condition of the Botanic Garden and Government Plantation, Adelaide, during the year 1885 has just reached us. Speaking first of the rainfall, Dr. Schomburgk says that the year was one of the driest and most ungenial that he ever had to contend with, the rainfall being no more than 15·887 inches, which was 2·851 inches less than the fall of 1884, and 5·272 below the average rainfall during the previous forty years. During September, October, November, December, and January no more than 3 inches of rain fell, and the heat during these months was abnormally great. The drought and heat combined had an injurious effect upon the vegetation, especially upon many of the trees and shrubs in the Botanic Garden, natives of cooler countries; the losses sustained, however, were not so great as was expected, owing to an abundant supply of water. On the other hand, in May and June severe frosts were experienced, so that tropical and sub-tropical plants and shrubs suffered greatly.

On the question of the introduction and acclimatisation of new economic plants, Dr. Schomburgk records his experience with many that have been widely distributed through the agency of the Royal Gardens, Kew, and have become known and established in other colonies as well as in India, such, for instance, as the Kumara (*Ipomœa chrysorrhiza*), the tubers of which form an article of food in New Zealand. Dr. Schomburgk says he believes that the plant will grow well in the gullies, because the climate there is cooler and moister than on the plains, and to some extent approaches that of New Zealand. The Gingelly oil plant (*Sesamum indicum*) is also reported upon favourably. The seeds were sown in drills in the open ground in October, and came up in about fourteen days. Considering that neither the dry spring nor the summer heat affected the plants, there seems no doubt that the species can be successfully cultivated in South Australia. The plant is an annual, and is very largely grown in warm countries for the sake of the sweet limpid oil now so much used for mixing with olive oil.

Under the head of *Rhopala* sp. an announcement is made of the receipt from Kew of a parcel of seeds of a tree belonging to the above-named genus, a native of Columbia, with the following extract from a letter of Mr. W. T. Thiselton Dyer:—"The Rhopala is a small contorted tree growing to about twenty feet in height. It is remarkable for being absolutely indestructible by fire, in large districts where the dry pastures and bush are burnt twice a year. Its resistance to fire enables it to exist to the exclusion of all other trees and bushes as a perfect natural plantation. The periodical burning destroys everything except this tree. The resemblance to a plantation is moreover enhanced by the circumstance that the trees never form thickets, and they are thickly and almost systematically dispersed over the land. The tree delights in the most sterile soils, but always of a stony or shingly character. Sometimes it grows in places so barren that even grass cannot exist. This suggests the idea that it may be turned to account in sterile districts within the tropics." Dr. Schomburgk expresses some doubt whether the plant will thrive out of doors with them, but thinks it may do well in the Northern Territory.

The Herbarium and Museum have both been considerably enriched by additional specimens during the year, so that the utility and efficiency of the whole establishment are thoroughly maintained.

THE AMERICAN ASSOCIATION

FROM the report in *Science* of the Buffalo meeting of the American Association we condense the following brief summary:—

Prof. Gibbs's masterly address, in the Section of Mathematics and Astronomy, upon the subject of "Multiple Algebra," was too long and of too technical a nature for presentation in full to our readers. His opening remarks were as follows:—

"It has been said that 'the human mind has never invented a labour-saving machine equal to algebra.' If this be true, it is but natural and proper that an age like our own, characterised

by the multiplication of labour-saving machinery, should be distinguished by an unexampled development of this most refined and most beautiful of machines. That such has been the case, no one will question. The improvement has been in every part. Even to enumerate the principal lines of advance would be a task for any one—for me, an impossibility. But if we should ask in what direction the advance has been made, what is to characterise the development of algebra in our day, we may, I think, point to that broadening of its fields and methods which gives us 'multiple algebra.'"

The speaker then gave a critical historical review of the different contributions of Hamilton, Möbius, Grassmann, Saint-Venant, Cauchy, Cayley, Hankel, the Peirces, father and son, and Sylvester, to these new methods of mathematical analysis, showing the additions and developments made by each to the various subjects.

In the second part of the paper Prof. Gibbs criticised the methods of some modern writers on these subjects, showing how they failed to grasp the full significance and bearings of the matters they were dealing with, being too much hampered by the old ideas and methods of simple algebra.

In the third part of his paper Prof. Gibbs directed attention more critically to multiple algebra itself, and inquired into its essential character and its most important principles.

Then followed a long discussion of the fundamental conceptions and methods of modern mathematics, which nothing but publication in full could render intelligible, and that only to mathematicians.

The fourth part of the paper was devoted to consideration of some of the applications of multiple algebra. From this we quote the following:—"First of all, geometry, and the geometrical sciences which treat of things having position in space,—kinematics, mechanics, astronomy, crystallography,—seem to demand a method of this kind, for position in space is essentially a multiple quantity, and can only be represented by simple quantities in an arbitrary and cumbersome manner. For this reason, and because our spatial intuitions are more developed than those of any other class of mathematical relations, these subjects are especially adapted to introduce the student to the methods of multiple algebra. Here Nature herself takes us by the hand, and leads us along by easy steps, as a mother teaches her child to walk. In the contemplation of these subjects Möbius, Hamilton, and Grassmann formed their algebras, although the philosophical mind of the last was not satisfied until he had produced a system unfettered by any spatial relations. It is probably in connection with these subjects that the notions of multiple algebra are most widely disseminated. Maxwell's 'Treatise on Electricity and Magnetism' has done so much to familiarise students of physics with quaternion notations, that it seems impossible that this subject should ever again be entirely divorced from the methods of multiple algebra. I wish that I could say as much of astronomy. It is, I think, to be regretted that the oldest of the scientific applications of mathematics, the most dignified, the most conservative, should keep so far aloof from the youngest of mathematical methods; and standing, as I do to-day, by some chance, among astronomers, although not of the guild, I cannot but endeavour to improve the opportunity by expressing my conviction of the advantages which astronomers might gain by employing some of the methods of multiple algebra. A very few of the fundamental notions of a vector analysis, the addition of vectors and what quaternionists would call 'the scalar part and the vector part of the product of two vectors' (which may be defined without the definition of the quaternion)—these three notions, with some four fundamental properties relating to them, are sufficient to reduce enormously the labour of mastering such subjects as the elementary theory of orbits, the determination of an orbit from three observations, the differential equations which are used in determining the best orbit from an indefinite number of observations by the method of least squares, or those which give the perturbations when the elements are treated as variable. In all these subjects the analytical work is greatly simplified, and it is far easier to get the best form for numerical calculation than in the use of the ordinary analysis."

Then followed illustrations of the various methods of applying multiple algebra to different classes of problems.

Prof. Brackett's address on "The Seat of the Electromotive Force" was essentially a *résumé* of the history of the investigations to find the source of the current in galvanic batteries. No attempt was made to settle the question, which has been so long a bone of contention.

In his address to the Section of Biology, Dr. H. P. Bowditch, of Boston, concluded that investigations into the chemical changes, the heat production, and the fatigue of active nerves, all tend to results more favourable to a kinetic than to a discharging theory of nerve action.

In the Section of Anthropology a novel and ingenious method of getting an insight into the unconscious mechanism of authorship was described by Mr. T. C. Mendenhall, under the title "Characteristic Curves of Composition." The method consists in counting the number of words of each length, from one letter to fourteen, fifteen, or as long as were found, and plotting the result on a curve, in which the abscissæ represented the number of letters in the word, and the ordinates the number of words per thousand of each length. It was shown that while the curve resulting from each thousand words was not entirely regular, that resulting from five thousand was much more regular, and that from ten thousand almost entirely so. The inference from this was, that the phenomenon which the curve represented was a regular one, and that it was an expression of the peculiar vocabulary of the author. Moreover, by comparing the respective curves, one would be able to judge whether two works were written by the same author, and perhaps even decide the controversy whether Bacon wrote Shakespeare. Mr. Mendenhall's method was to count a thousand words at a sitting, and then turn to another part of the book. One soon acquired the art of counting at a glance the number of letters in each word, and, with an assistant to record the result, one thousand words could be counted in a half-hour. Curves derived from Dickens ("Oliver Twist") and Thackeray ("Vanity Fair") were remarkably similar, thus suggesting that the subject-matter might cause the peculiarity of the curve, while those from John Stuart Mill ("Political Economy" and "Essay on Liberty") differed from them in having more long words and fewer short ones, though words of two letters (prepositions mainly) were most abundant in Mill. The average length of the novelists' words was 4·38, and that of the philosopher 4·8.

The geological interest of the meeting at Buffalo naturally centred in the excursion to and discussion of the Falls and gorge of Niagara. Dr. Pohlman, of Buffalo, described the district to be visited on Saturday, and called particular attention to the occurrence of drift-filled antecedent channels on the line selected by the post-Glacial overflow of Lake Erie, which would gradually diminish the amount of rock-cutting required in the excavation of the present gorge, and thus reduce the time since the overflow began. The geological members of the excursion party therefore gave close attention to these matters, and, as a whole, regarded the heavy drift between the sloping rocky banks at the whirlpool, and the wide, open valley, with its plentiful drift at St. David's, as sufficient evidence of an old buried channel connecting these points, and probably heading up above the whirlpool towards the bridges. But there seemed no sufficient reason for any confident belief in a branching old valley from the whirlpool towards the Lewiston bluffs: in making this lower part of the gorge there must have been a long period of deep rock-cutting between the first leap of the Falls over the bluff and the time of their discovering the old drift-channel and the whirlpool. The estimate of the age of the Falls was presented by Messrs. Woodward and Gilbert, of the Geological Survey, and their remarks greatly interested a large audience that had gathered on the announcement of the discussion. Mr. Woodward had just completed a survey of the Horseshoe Falls, and by comparing his results with those of the State Survey in 1842, and of the Lake Survey in 1875, he found an average recession for the whole face of the Fall of about $2\frac{1}{10}$ feet per annum; but as the central parts of the curve, where the water is deepest, has retreated from 200 to 275 feet in the eleven years since 1875, an average retreat of 5 feet per annum does not seem at all improbable. Mr. Gilbert then discussed the beginning of the Falls as controlled by the drainage of the lakes. When the retreating ice-sheet stood so as to obstruct the St. Lawrence and Mohawk drainage channels to the east, a broad sheet of water, representing a confluent of Erie and Ontario, stood at a high level over the present Niagara limestone plateau, and probably drained south-westward to the Ohio. When further melting opened the Mohawk Channel, the great double lake fell to a lower level, and was separated into its two members, Ontario sinking to the level of its outlet at Rome in Central New York, but Erie being held higher by the rim of the Niagara plateau. This was the birth of the river and the Falls, and since then they have been at work on the gorge. The age of the falls thus carries us back to a tolerably definite point in

the decline of the Glacial period. On the supposition of a uniform rate of recession, the age of the Falls equals the length of the gorge divided by the annual recession; but the rate has been undoubtedly varied by changes in a variety of conditions, which must be allowed for. As thus qualified, Mr. Gilbert gave it as his conclusion that the maximum length of time since the birth of the Falls by the separation of the lakes is only 7000 years, and that even this small measure may need significant reduction.

In the Section of Chemistry, H. C. Bolton, of the Committee on Indexing Chemical Literature, after presenting their report showing the large amount of valuable work which was being done, read a paper on the confusion which exists in the abbreviations employed in chemical bibliography, and the desirability of uniformity in designations of scientific periodicals.

C. F. Mabery's paper "On the Products of the Cowles Electric Furnace," was of particular interest, and attracted much attention. He stated that the past year had been devoted more especially to the development of an increased commercial efficiency of the furnace, so that now 300 horse-power could by means of a large dynamo, be applied with greater economy in the results; and by coating the charcoal employed in the furnace with lime, by soaking it in lime-water, the production of graphite was largely avoided, and a marked improvement in the working of the furnace introduced. The results—although, as compared to what would eventually be accomplished by electric smelting, they may seem crude—have reached a stage where their commercial success can be demonstrated. It was also found that when the electrodes entered the mixture in a slanting position the product was increased. They are now also moved in and out with advantage, being gradually withdrawn as the resistance falls. Prof. Mabery replied to the criticisms of Hehner of Berlin, Siemens, and others, that no new principle was involved, showing that the Cowles furnace is quite different from all hitherto constructed, and the only one of practical application by which a dynamo of 300 horse-power could be used, as by means of a resistance-box and the arrangement of the furnace, the sudden breaking of the current is prevented from burning out the dynamo. The presence of copper for the reduction of aluminium was shown to be unnecessary; and, by complete exclusion of air from the furnace, buttons of the metal were easily obtained. A product which has attracted considerable attention during the past year is obtained by reducing aluminium in presence of iron. A cast iron is formed containing sometimes as much as 10 per cent. of aluminium, and this product is used to facilitate the working of crude iron, and to introduce into the various grades a small percentage of aluminium. In the reduction of aluminium in the presence of copper a yellow product is frequently taken from the furnace, which is composed of metallic aluminium to the extent of one-half or three-fourths, the balance being silicon and copper. It is also formed in the absence of copper, and then contains a higher percentage of aluminium, and always contains nitrogen. It has a resinous lustre, and decomposes water at 100°.

In the Section of Physics, Prof. T. C. Mendenhall prefaced his paper on "Electric Thermometry" by saying that the strictures upon the mercurial thermometer should not be carried too far. It has been of great value, though it may now fail to meet new demands. Electric thermometry is receiving especial investigation at the Signal Office, particularly from the meteorological stand-point, with some promising results. Prof. Mendenhall reported the progress which had been made in the study of atmospheric electricity during the past year. It is not time to begin to think of the origin of atmospheric electricity. The problem is its distribution and the relation, if there be any, to weather changes. Some very interesting results have been reached. In ordinary weather the electrical condition is undergoing constant and rather wide variations, which are very local, as two collectors only a few feet apart may give curves differing considerably, though similar in their wider variations. When an electrical storm occurs, the curves over a wide area may be similar in general outline. Prof. Mendenhall also noted a phenomenon entirely new to him; namely, that resistance-coils, after a current it passed through them for some time, upon short-circuiting will yield a reverse current for hours. This phenomenon can no doubt be classed under the general head of polarisation, yet by simple polarisation it would be difficult to account for persistence of current. This makes caution necessary in the use of resistance-coils, in order that any effects of this kind may be carefully noted. In one instance the apparent resistance of a coil was found to increase fourfold when the current was reversed.

A paper by Prof. Abbe created some discussion. The point of the paper was that, as the force of gravity varied from the equator to the poles, 30 inches of mercury in the barometer indicated a less gaseous pressure, and consequently less density of the atmosphere, at the equator than 30 inches at the poles, and hence a correction for latitude should be introduced in allowing for refraction. He showed that, for the difference of latitude of Pulkowa and Washington, it would make 0″·1 difference in the refraction at 45° of zenith-distance, and might be sufficient partly to account for differences in systems of star declinations which depended upon observations at great zenith-distances.

In the Section of Biology, the paper of Messrs. J. M. Coulter and J. N. Rose, giving a synopsis of the North American pines, based on leaf-structure, was of especial value from a systematic stand-point, from the fact that any species in this somewhat difficult group can at once be distinguished by the peculiarities of its minute leaf structure; and the results of the author's observations are shown to be worthy of attention from the fact that a classification based on these characters is, in its broader features, closely like that of the late Dr. Engelmann, which, as is well known, took into consideration the whole tree.

The relations of germs to disease naturally occupied a prominent place in the proceedings of the Section, and the presence of over half a dozen investigators in this line made the discussions interesting. Dr. D. E. Salmon read two papers bearing on the causes of immunity from a second attack of germ diseases. There are three possible explanations:—(1) Something is deposited in the body during the attack which is unfavourable to the germ; (2) something has been withdrawn which is necessary to its development; (3) the tissues have acquired such a tolerance for the germ or for an accompanying poison that they are no longer affected by it. Dr. Salmon favoured the last view, and gave details of a large number of experiments to substantiate his opinion. He said that Metchinkoff's phagocyte theory was not wholly satisfactory, and that large doses of the germs were more powerful than small ones. He attributed their action to a poison which was a result of their growth, and thought that a large dose had a greater effect because the poison benumbed or killed the cells, thus giving the Bacteria a better chance to grow and to thus produce more poison.

Dr. Joseph Jastrow gave an account of some physiological observations on ants, in which he was able, by simple but ingenious means, to study the rate of walk of these insects, and stated that his results, so far as they went, confirmed the opinions of others that the smaller the animal the more rapid the step, and also the more quickly fatigue was produced. Dr. Jastrow also had some observations on the dreams of the blind, taken mostly from persons who had lost the sense of sight before the age of five. In these cases the dreams were all in terms of hearing. In the case of Laura Bridgeman the dreams were apparently based on touch. In persons who become blind between five and seven, sight terms played an important part in dreams. The relation of these facts to the development of the sight-centres was pointed out.

PHOTOGRAPHIC DETERMINATIONS OF STELLAR POSITIONS[1]

IT has been suggested that a short account of my work upon stellar photographs for the attainment of accurate observations might be acceptable to the astronomical section. My intention had been to attend this meeting as a listener and learner only, but I comply with the suggestion the more readily, since, by a notable coincidence, I spoke upon the same subject in this place just twenty years ago this week. It is true that my communication then was only an oral one, and never reduced to writing, for the successful establishment of the Atlantic cable, of which I had received notice that day, called me away suddenly, before the time fixed for the regular presentation; but an elaborate written memoir upon the subject had been presented to the National Academy, ten days previous, at Northampton.

The early history of celestial photography is demonstrably and exclusively American; and its use as a method of delicate quantitative research is very markedly so. Without entering upon

[1] Paper read at the Buffalo Meeting of the American Association for the Advancement of Science, August 20, 1886.

See note on page 502.

the historical data, which are of easy access to every investigator, I may mention that No. 77 of the *Astronomical Journal* contained nineteen photographic impressions of as many different phases of the solar eclipse of 1854, May 26—the moment of each impression being given to the nearest tenth of a second. These were taken at West Point, under the direction of Prof. Bartlett, of the U.S. Military Academy, and form a part of his memoir, in which he also gives the distances between the cusps, as measured by himself with the micrometer in the telescope. Ten years later, in 1864, Mr. Rutherfurd constructed the 11½-inch photographic object-glass which has acquired so conspicuous a place in astronomical history; and with this, in addition to its other achievements, he obtained sharp photographic stellar images, with a definition previously unknown, taking for the first time distinct impressions of stars invisible to the naked eye, in fact to the 8¾ magnitude for white stars.

After constructing a micrometer of great delicacy for the measurement of these plates, he measured with this the relative distances and position-angles of the stars which they contained. And in the spring of 1866 he kindly placed in my hands the results thus derived from three plates of the Pleiades, each containing two impressions, taken on the evening of March 10. One of these plates contained forty stars. Bessel's memoir upon the Pleiades, published in 1844, gave the relative positions of fifty-four stars, measured with the Königsberg heliometer, during the years 1829 to 1841. Six of these fifty-four do not belong within the limits of the plate (which contains about one square degree), and ten of them are too faint for the photographic record, so that sixteen of Bessel's list are wanting; but, on the other hand, there are two additional ones, not observed by him.

From this fact alone it may be perceived that among the great benefits which astronomy may be justified in expecting from celestial photography, the accurate determination of magnitudes does not find place. The chemical action of the stellar light upon the film is so dependent upon the character of that light that, in the absence of a correct knowledge of its composition, we are very easily deceived regarding the amount. Thus one of Bessel's stars which was not recorded upon any of Mr. Rutherfurd's plates is estimated by Argelander as of the magnitude 8·0, and by Wolf as 7¾, while five are distinctly recorded which Argelander calls 8½ or less, and eight which Wolf so estimates. The spectroscope would doubtless show a deficiency of the more refrangible rays in the light of the former, and a preponderance of the same in that of the latter.

This series of measurements by Mr. Rutherfurd, together with the computations to which the results were submitted, constitute, if I am not mistaken, the first application of the photographic method to exact astronomical determinations. And the investigation necessarily demanded especial care, both for guarding the numerical results against sources of unsuspected error and for fixing the limits within which known theoretical errors would remain unappreciable.

The importance of the successful application of a method so different from all previous ones, and so full of promise, and also the considerable time which would inevitably elapse before the memoir could be printed, led me at the same time to communicate to the *Astronomische Nachrichten*, at Altona, some of the resultant values. In a comparatively short note, written about the middle of August 1866, I gave for the ten most conspicuous stars of the Pleiades, after Alcyone, the corrections derived from one of the photographic plates of March 10, for the values, published by Bessel, for the position-angles and distances, from Alcyone in 1840, as likewise the average discordance found for a single measure.

In the next following year the Academy had not the means of printing its memoirs; and as in the meanwhile Mr. Rutherfurd had measured five more of the plates of the Pleiades previously taken, as well as six additional ones taken in the months of January and February 1867, these were also computed, and the results added to those from the first three plates in the memoir already written.

Various circumstances combined to delay the publication, chief among them being what seemed to me a manifest impropriety in printing the results derived from photographs and measurements made by Mr. Rutherfurd, and by his own methods, before some account of these methods should have been published by him. His communication on the subject had been made to the National Academy immediately previous to my own, but was not yet in such form as he desired for publication.

The result showed a very remarkable accordance with Bessel's determination for 1840, although the total amount of relative proper motion during the elapsed twenty-six years was comprised in the differences.

This memoir still remains in its original form, but unpublished; the results being deduced from twenty-four photographic impressions upon fourteen plates.

In the next year, 1868, I had the gratification of receiving from Mr. Rutherfurd the results of his measurements of thirty-two stars of the cluster Præsepe, derived from eleven impressions. These were computed in the same way that those of the Pleiades had been, and an analogous memoir upon this cluster was prepared for the National Academy.

Before leaving the country, early in 1870, I gave these two memoirs to Mr. Rutherfurd, with the request that he would send them to the printer, at the same time with his own paper, already mentioned, but not before then. The condition of his health prevented him from attending to the matter for some time, and in the interval he arrived at the unpleasant discovery that the screw of his micrometer had suffered from wear, and to an extent which led him to fear a want of that accuracy of which the method is susceptible, and which he hoped to see demonstrated by its very first applications.

Notwithstanding this possible blemish, it seems to me that the results ought to be now made public in their original form, after due mention of the circumstances; and it is among my hopes to be able soon to publish these two memoirs from the original manuscript of so many years ago.

The method was received with manifest distrust and disregard abroad; and, as was but natural for so essential a deviation from former methods, very many grounds of criticism and objection were brought up. One of the principal of these was the possible distortion of the collodion film, after receiving the impressions and before the measurements; but Mr. Rutherfurd speedily disposed of this point, at least so far as the albumenised plates are concerned; and, moreover, the combination of measurements of the same stars derived from various plates will at once make manifest the degree of confidence to which the several values and their wear are respectively entitled.

A far more serious obstacle to accuracy is presented by the difficulty of obtaining absolutely round images. Irregularity of form in the dots formed by the stellar impressions is almost incompatible with precision of measurement; and, as the time of exposure must often be long, the chief problem was, not so much to obtain the images as to insure uniformity of motion in the telescope during the period of exposure. Not that the photographic processes were not troublesome enough before the introduction of the dry-plate processes, for very great care and numerous precautions were often necessary to prevent the plates from drying too fast: but far the greatest difficulty consisted in obtaining sufficient precision in the clockwork and equatorial motion of the telescope.

It may easily be imagined how great was my desire, when leaving home for South America, to extend this new method of observation to the southern hemisphere. But the obstacles encountered in the endeavour cannot be easily imagined. Upon these I will not enlarge here further than by saying that in Cordova also the attainment of circular dots for the star images offered incomparably the greatest of all the difficulties of a practical character. The time of exposure was limited by the maximum size allowable for the large stars, and, previous to 1878, also by the drying of the plate, although exposures of twenty minutes were not unusual. Nevertheless, by dint of specially constructed governors and regulators, and by ceaseless attention, we did succeed in obtaining impressions which, to the unaided eye, appear absolutely round.

This necessity of long-continued and minute uniformity in the motion of the telescope is, of course, largely diminished by the employment of instruments of large aperture, inasmuch as the necessary time of exposure is diminished in the same ratio in which the amount of light is increased. It is yet further and most notably diminished by the manifold greater sensitiveness of the dry gelatine plates. But notwithstanding all this, the attainment of round images, while almost indispensable for giving to stellar photography that increased accuracy to which it may lay claim as a means of research in practical astronomy, still demands especial care and precaution.

The Argentine Government cordially afforded every assistance which I deemed it proper to ask for these investigations. And although the chief energies of the Cordova Observatory

were absorbed by those investigations for which the institution was established, I had the satisfaction of obtaining a sufficient number of stellar photographs to occupy not only my own lifetime, but many more, in their measurement and proper computation.

We photographed no northern stars there except the Pleiades and the Præsepe. Of the Pleiades I brought home sixteen plates, with two impressions of the whole group upon each, made in five different years, from 1872 to 1882, inclusive. Although the centre of the cluster never attains a greater altitude at Cordova than 34° 50′, some of the plates contain seventy stars. All but one of Bessel's stars are there, which belong within the limits of the field, the missing one being of the magnitude 9½, and there are yet other stars of the magnitudes 10, 10½, and 11. Of the Præsepe there are five plates, and with a correspondingly increased number of stars.

About seventy southern clusters have been repeatedly photographed at Cordova, comprising all those of the southern hemisphere which seemed important, also somewhat more than a hundred double stars, being a sufficient number to serve as a good test of the method. The total number of photographs now on hand is somewhat less than 1300, only few having been preserved in which the images were not circular.

Especial attention, however, was given for many years to taking frequent impressions, at the proper seasons, of four stars selected, on account of their large proper motion, as likely to manifest appreciable annual parallaxes. The refined and elaborate observations of Drs. Gill and Elkin, at Cape Town, have been made, computed, and published, while the Cordova photographs have lain untouched in their boxes. There is but one of my four stars, β Hydri, which is not included in their list. Still, it will be a matter of much interest to apply the photographic investigation to the same problem, even if for no other purpose than a comparison of the results of the two methods.

I am convinced that the Cordova plates contain a large number of stars as faint as the eleventh magnitude of Argelander's scale, and believe that these are much the earliest photographs of stars fainter than Mr. Rutherfurd's of 1865 and 1866. There are several plates, covering about a degree square, which cannot contain less than 550 stars, and I believe that some of them contain a greater number. Such are those of the cluster Lac. 4375 and that near X Carinæ.

The region in the vicinity of η Carinæ, and that magnificent tract in Sagittarius which is too densely sown with stars to be considered merely a portion of the Milky Way, and yet too large and undefined to be regarded simply as a cluster, were both of them taken several times, during the years 1875–82, in series of overlapping photographs, each containing about a square degree, and recorded upon a glass surface of 9 by 12 centimetres. In their present form they are of course of small value for scientific use, inasmuch as the stars are too crowded for their configurations to be easily perceived; and although these two series form, in fact, maps of considerable regions in the sky, still the record is of a very perishable nature, and of small avail for use by astronomers until it shall have been translated into an enduring and numerical form by micrometric measurement.

In this connection I may say that one of the greatest of my present anxieties regarding the Cordova photographs arises from a discovery of the ease with which the collodion or gelatine film may become detached from the glass. The Argentine Government has assigned a moderate sum for the prosecution of the measurements, and with this some progress has already been made. It is but right to add that the full amount was given for which I asked. Still, it is now quite inadequate, in consequence of the unfortunate depreciation of the national currency; and, in the present financial crisis there, I cannot reasonably expect more. Yet this matter of prompt measurement appears to me at present much more important than it did while I was unaware of the facility with which the film can blister and peel.

In 1883, after Mr. Common's brilliant success in photographing nebulas with his great 3-foot reflector, he proposed to me a joint arrangement for photographing the whole heavens. My work at Cordova was so near its close that it was out of the question to undertake anything new; but the immense labour requisite for the measurement of the plates would, under any circumstances, have tended to deter me. It is an undertaking demanding the joint energy, application, and material resources of a large number of persons, if the results are to be made available for astronomical use; indeed, I see no other astronomical value in the unmeasured photographs than the possibility of confirming at some future epoch the existence of relative motion previously detected or made probable by some other investigation.

Since then the process of photographic charting is said to have been systematically undertaken by the Brothers Henry at Paris. I have seen none of their plates; but their sharpness is highly spoken of, and the work appears to be prosecuted with much skill and very sensitive plates. There can of course be no question as to the value of any permanent record whatsoever, corresponding to a known date; yet I cannot feel that any essential advance is likely to be made in this way until the photographic record shall have been brought within the range of numerical expression.

The measurements of the Cordova photographs, thus far completed, are those of the double stars, the four stars with large proper motion, of the Pleiades, of the Præsepe, and of the clusters Lac. 4375 and κ Crucis. The corresponding computations have been made, as yet, only for a portion of the Pleiades impressions, but I am hopeful of completing all these at a comparatively early date. We shall then be able not only to compare the results with Bessel's of forty-five years ago, but to test the deduced values of the proper motions by means of the photographic determinations of 1865 and 1866. Meanwhile, the valuable memoir of Wolf has been published, giving closely approximate positions for 571 stars of the group, and Dr. Elkin has recently been executing at New Haven a heliometric triangulation of the principal stars. Our photographic results will have to be confronted with his delicate heliometric ones; and, should they bear this test with tolerable success, it will be all that can reasonably be desired.

B. A. GOULD

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

PROF. W. GRYLLS ADAMS, F.R.S., will deliver, at King's College, London, a course of lectures on Electricity and Magnetism and their applications to Electric Lighting, Transmission of Power, &c., during the academical year 1886–87. A course of practical work in Electrical Testing and Measurement with especial reference to Electrical Engineering will also be carried on under his direction in the Wheatstone Laboratory. In the Wheatstone Laboratory, which is open daily for research from 1 to 4, except on Saturdays, there are special courses of practical work for students preparing for the Science Examinations of the University of London.

IT is purposed to celebrate, in a befitting manner, from November 6 to 8 next, the 250th anniversary of the founding of Harvard University, Cambridge, Massachusetts. The University was established on November 7, 1636, by an Act of the Colonial Legislature, and was named after John Harvard, who was a liberal benefactor of the new institution. Harvard is the oldest University in North America. The southern portion of the Continent possesses one many years older—the University of St. Mark, at Lima, founded in 1551 by the Emperor Charles V.

SCIENTIFIC SERIALS

Bulletin de l'Académie Royale de Belgique, July.—Modern kinetics and the dynamism of the future, by G. A. Hirn. The author replies to the arguments urged by M. Clausius against his view of the kinetic theory in its application to the resistance of gases. He continues to treat the question in connection with his peculiar spiritualistic opinions, and endeavours to overthrow the theory now generally accepted by physicists, because of the disastrous consequences which he supposes it would have on the progress of mankind.—On a class of conjugated polynomes, by J. Deruyts. This memoir, which is a further development of the author's previous researches, deals more especially with the important functions presented by certain polynomes in the approximate calculation of definite integrals.—On the distribution of the regenerate nerves, by C. Vauclair. In this paper the author deals with the peripheric distribution of the regenerate nerves compared with that of the primitive nervous system.—Essay on the origin of the Fraunhofer rays in relation to the

constitution of the sun, by Ch. Fievez. Given the high temperature, chemical composition, and slight mean density of the sun, its chemical elements cannot exist in the solid or fluid state, or even to any large extent in the condition of highly compressed vapours. Assuming, further, with most physicists, that the sun consists of a gaseous mass whose temperature increases from the circumference towards the centre, it is argued that the solar spectrum must be formed by the superposition of all the radiations of the chemical elements present in the sun. The luminous part of the spectrum would thus be constituted by the radiations of like vibratory period, and Fraunhofer lines by the radiations of unlike vibratory periods. From this it would follow that a chemical element might exist in the sun without being revealed by a dark line in the solar spectrum.

Schriften der Physikalische-Ökonomischen Gesellschaft zu Königsberg i/Pr., 1885.—Herr Fritsch here gives the result of a study of certain gaps in the pith of Coniferæ, discovered by Prof. Caspary some years ago. In its middle course the pith of a year's growth consists of elongated parenchyma, but at the end of the growth it presents cubic or egg-shaped cells in loose union. Those gaps the author finds in species of the genera Abies, Picea, and Larix, and in *Cedrus Deodara*. The last-named differs from the others in not having a partition of cross-lying cells through the pith, above the gaps. All Coniferæ with persistent bud scales have this, and some Coniferæ (*Tsuga canadensis* and *Torreya nucifera*) have it, and are without the gaps. Finally, the Junipereæ, Podocarpeæ, Taxineæ, and Pinus have neither. The gaps seem to arise through stretching of the wood-cells, and their size depends on the age and moisture of the stem and branches.—Herr Franz writes on the magnetism observed at the end of long iron well-tubes (200 and 250 m.) at Königsberg, and of some railway lines. The attractive force was proportional to the distance (not its square), the magnetism being pretty equally distributed over a line several metres long. In one well, the horizontal component at 1 metre distance was as much as fifteen times that of the earth's magnetism.—Herr Klien describes experiments in plant cultivation by the water-method (specifying the substances given in solution and their amount), and points out its advantage in study of the action of poisons, such as the sulphocyanite of ammonium occurring in ammonia superphosphate from gas manufacture, and spoiling that product for manure purposes.—A paper by Herr Scharlop appears to throw light on the production of some prehistoric urns in Prussia, from a mode of manufacture which has lately died out.—Dr. Tischler discusses the representations of weapons and costumes on old bronzes of the Hallstadt-Italian period.

SOCIETIES AND ACADEMIES

LONDON

Entomological Society, September 1.—Robert McLachlan, F.R.S., President, in the chair.—The following gentlemen were elected Fellows:—The Rev. Prof. Dickson, D.D., and Messrs. P. Cowell, A. O. Walker, and Lyddon Surrage.—The President remarked with regard to the gnats from the Kent Waterworks, exhibited at the last meeting, that Prof. Westwood had since informed Mr. Douglas that they were only *Culex pipiens*.—Mr. Slater exhibited certain parasites found on the body of a larva of *Smerinthus tiliæ*, which Mr. Waterhouse believed to be *Uropoda vegetans*, a species of *Acari*.—Mr. W. Warren exhibited *Eupithecia fraxinata*, *E. innotata*, a variety of *E. satyrata*, a *Gelechia* caught in Wicken Fen twenty years ago by Mr. Bond, and believed to be a new species, *G. fumatella*, *G. vilella*, *Lithocolletis scabiosella*, and *Catoptria parvulana*. He also exhibited larvæ of *Gelechia vilella*.—Mr. South exhibited specimens of *Dicrorampha distinctana*, and stated that he considered it to be merely a local form of *D. consortana*, from which, in the larval stage, it could not be separated.—Mr. Stevens exhibited a living specimen of *Clerus formicarius*, recently found under the bark of an ash-tree in Arundel Park.—Mr. Billups exhibited *Chrysis succincta*, Linn., taken by sweeping at Chobham on July 28 last; he also exhibited *Microphysa elegantula*, taken at Broadstairs in August last.—The Rev. W. W. Fowler exhibited, on behalf of Mr. Theodore Wood, a larva of *Langelandia anophthalma*, a species new to Britain.—Mr. H. Goss exhibited specimens of *Oxygastra Curtisi* recently taken near Christchurch, Hants. He stated that he had met with the species in the same locality in 1878, but had never seen it anywhere else in the United Kingdom, nor was he aware of any recent record of its capture. Mr. McLachlan observed that the species was taken many years ago in Dorsetshire by the late Mr. Dale, but that he knew of no recent captures except those recorded by Mr. Goss. He also made some remarks as to the distribution of the species on the continent of Europe.—Mr. McLachlan exhibited a specimen of *Dilar meridionalis* taken by him in July last in the Pyrenees, also about 150 examples of the genus *Chrysopa* from the same district. Amongst them were *C. vulgaris*, *perla*, *Walkeri*, *viridana*, *tenella*, *prasina*, *flava*, *septempunctata*, *flavifrons*, and others not yet fully identified. He also exhibited a few Coleoptera from the same district, and remarked on the extraordinary abundance of a pretty Lamellicorn, which was so common as to give the meadows the appearance of being studded with multitudes of brilliant blue flowers.—Mr. C. O. Waterhouse called attention to the numerous reports which had lately appeared in the newspapers of the supposed occurrence of the Hessian Fly (*Cecidomyia destructor*) in Britain, and inquired whether any communication on the subject had reached the Society. The Rev. W. W. Fowler stated that he had been in communication with Miss Ormerod on the subject, and that she had informed him that neither the imago nor larva of the species had been seen, and that the identity of the species rested on the supposed discovery of the pupa.—Mr. A. H. Swinton communicated a paper entitled "The Dances of the Golden Swift." In this paper the author expressed an opinion that the peculiar oscillating flight of the male of this and allied species had the effect of distributing certain odours for the purpose of attracting the females.

PARIS

Academy of Sciences, September 27.—M. Émile Blanchard in the chair.—Researches on the sugars, by M. Berthelot. The results are given of recent studies of some new principles obtained from the association of sugars with themselves, not by a stable combination of the class of saccharoïd substances, but by a combination easily dissolved, analogous to that of the hydrates and alcoholates. The facts observed illustrate the difficulties so often met with in the preparation of the double salts. They supply a fresh proof of the special part played by the dissolvents in the extraction of immediate principles, for, according as water or alcohol is employed, melitose or raffinose may be obtained.—Conditions determining the rapidity of images in chronophotography, by M. Marey. By the process here described, which is based on M. Chevreul's method of obtaining a perfectly black ground, the author is enabled to reduce the time of pose for each image to the two-thousandth of a second, and hopes by further improved dispositions to reduce it still more. The new photographs show that this reduction of time greatly increases the delicacy of the images obtained by this process of chronophotography.—Kinematic analysis of the locomotion of a horse, by M. Marey. In this paper are described and illustrated the movements of the fore-leg in the step, trot, and gallop. The tendency to economy of labour displayed in various degrees in the movements of all "animal machines" appears to attain the greatest perfection in the action of the horse, being, however, less evident in the trot and the gallop than in the slow pace.—Note on the removal of the Imperial Observatory of Rio de Janeiro to a new site, by M. Cruls. The new site, to which the Observatory will soon be removed, occupies about 40 hectares (100 acres) of the Imperial Fazenda of Santa Cruz, the usufruct of which is granted by the Emperor for this purpose. The new Observatory will stand on the same parallel, and about 2 metres to the west of the present establishment, and will be able to undertake observations both on atmospheric electricity and terrestrial magnetism much more successfully than was possible in its old home.—On the transformation of algebraic surfaces in themselves, and on a fundamental number in the theory of surfaces, by M. E. Picard. Having recently shown that surfaces capable of transformation in themselves by a birational substitution, including two arbitrary parameters, are of the genus zero or one, the author now examines the case of a single parameter, which he finds leads to totally different conclusions.—On a new method of determining the coefficient of expansion for solids, by M. Robert Weber. If a solid body be suspended like a pendulum, its oscillations will depend upon its form, its mass, and the distance of its molecules from the axis of rotation. At two varying temperatures this distance varies, whence results a change in the oscillations. Hence for a given body there is a determined relation between its temperature, u, the coefficient

of expansion, *a*, its dimensions, *d*, and time of oscillation, *t*. The value of *a* with these data may be calculated by the process here described, and in a future communication the author promises some values of coefficients of expansion determined by this method.—On the microscopic flora of sulphurous waters, by M. Louis Olivier. While prosecuting his researches on the reduction of the sulphates by living beings, the author has been led to the discovery of low organisms in sulphurous cold and thermal waters. These organisms are found to be very active at very high temperatures, thriving and multiplying themselves in the hot springs of Des (Eufs (Cauterets), and elsewhere, at temperatures of from 46° to 50° C. Carefully collected and transplanted to an extract of beef, they continued to propagate at 65°, and even nearly to 70° C.—Influence of the organism of the guinea pig on the virulence of tuberculosis and scrofula, by M. S. Arloing. It results from several experiments that the virus of scrofula is not intensified by its presence for two generations in the guinea-pig. But the effect is different with true tuberculosis, which in its attenuated forms acquires by inoculation sufficient virulence to affect the rabbit, an animal otherwise so difficult to infect with this poison.—On the vascular system of the Echinidæ, by M. Henri Prouho. In reply to a statement recently made by M. Kœhler, the author shows by numerous quotations that, except on two points, their views are not in accord on the vascular system of these organisms.—The earthquake of August 27, 1886, in Greece, by M. Léon Vidal. The paper contains a detailed account of the disturbances in various parts of the mainland and adjacent archipelagoes, from which it appears that the phenomenon was due to a general cause situated somewhere to the south-west of the Island of Alphios, beyond the Strophades.—Remarks on a chart representing the Granitic and Cretaceous formations of the Spanish Pyrenees, and their disposition in a series of oblique ridges, by M. F. Schrader. On this map, drawn to a scale of 1 : 200,000, the author gives the results of his own surveys in a deep colour, marking off the districts which he has not yet visited, and for which he has utilised the works of Dafrénoy and Élie de Beaumont.—Explanation of the solar spots and faculæ, by M. J. Delauney. To explain these phenomena it is assumed that the sun consists of a very hot nucleus of metals in the fluid state wrapped in an atmosphere at a very high temperature and pressure, and formed almost entirely of hydrogen; further, that the nucleus contains in solution a large quantity of gas derived from the atmosphere; that the atmospheric pressure is least at the poles and at the equator, with a maximum at low latitudes on either side of the equator; lastly, that this atmosphere is subject to variations of pressure. The spots would then be caused by any atmospheric depression in any region of the solar surface, while the faculæ would correspond to an inverse phenomenon, the atmospheric hydrogen being absorbed or dissolved by the nucleus under the influence of high pressures. The spots would be the result of a cyclone, the faculæ of an anti-cyclone, the former being accompanied by a diminution of heat employed to transport the hydrogen from the interior of the sun to and even beyond the atmosphere, while the latter represent a liberation of heat resulting from the precipitation of the hydrogen absorbed in the solar mass.

STOCKHOLM

Academy of Sciences, September 15.—A refutation of the remarks of Dr. Hoppe on the new theory of unipolar induction, by Prof. E. Edlund.—On the Salmonidæ of the Swedish State Museum with reference to a work recently published on them, by Prof. F. A. Smith.—On the new parts (15-17) of "Algæ aquæ dulcis exsiccatæ quas distribuerunt," V. Wittrock and O. Nordstedt, exhibited and commented upon by Prof. V. Wittrock.—Researches on the general Jupiter-perturbations of the asteroid Thetis, by Herr C. V. L. Charlier.—Some new developments of the elliptic functions, by Prof. Hugo Gyldén.—On the habits of two Swedish species of the solitary wasps, by Prof. Chr. Aurivillius.—On a new nitro-naphthaline-sulphur-acid, by Prof. P. T. Cleve.—On glycolurite and acetylurea, by Prof. O. Widman.—On the products of oxidation of the ortho-nitrocumenolocryl-acid and its combinations, by the same.—New researches on the re-arrangements of the atoms in the propyl group, by the same.—On the curve of coincidence of the common algebraic differential equations of the first order, by Prof. C. F. E. Björling.—On the integration of the differential equations in the problem of the N-bodies, iii., by Prof. Dillner.—On the connection between the coefficients of expansion and the coefficients of elasticity at different degrees of temperature, by Prof. G. R. Dahlander.—On the determination of sulphur and haloods in organic combinations, by Dr. P. Klason.

BOOKS AND PAMPHLETS RECEIVED

"Lehrbuch der Vergleichenden Anatomie der Wirbelthiere," by Prof. Dr. R. Wiedersheim (Fischer, Jena).—"Edinburgh Astronomical Observations," vol. xv., by Prof. P. Smyth (Neill and Co.).—"Pictorial Arts of Japan," part 4, by Wm. Anderson (Low and Co.).—"A Treatise of Spherical Trigonometry," part 2, by W. J. McClelland and T. Preston (Macmillan and Co.).—"Illustrated Hand-book of Victoria, Australia (Ferres, Melbourne).—"Journal of Statistical Society." September (Stanford).—"Euclid Revised," Books i. and ii., by C. J. Nixon (Clarendon Press).—"Hand-book of Zoology," 3rd edition, by Sir J. W. Dawson (Dawson, Montreal).—"Bulletin of the Amer. Mus. of Nat. Hist.," July 1886 (New York).—"British Fungi," vol. ii., by J. Stevenson (Blackwood).—"Challenger Reports, Zoology," vols. xv.-xvi.—"Explosions in Coal-Mines," by W. N. and J. B. Atkinson (Longmans).—"Philosophische Studien," Dritter Band, 4 Heft, by W. Wundt (Engelmann, Leipzig).—"Proceedings of the Boston Society of Natural History," vol. xxiii. part 2 (Boston).—"Memoirs of the Boston Society of Natural History," vol. iii. No. 12, by W. K. Brooke; No. 13, by S. H. Scudder (Boston).—"Des Mesures absolues de la Chaleur rayonnante," by K. Angström (Upsal).—"Stonyhurst College Observatory: Results of Meteorological and Magnetical Observations, 1885," by Rev. S. J. Perry.—"Rules regarding Defects of Vision," by Sir J. Fayrer (Churchill).—"Ancient and Modern Methods of Arrow Release," by E. S. Morse (Essex Inst.).—"Results of Experiments at Rothamsted on the Growth of Barley," by Prof. J. H. Gilbert.—"Descriptive List of Native Plants of South Australia Recommended for Cultivation," by J. G. O. Tepper.

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